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NAVAL OUTGOING MESSAGE PROCESSING, A STUDY OF MESSAGE GENERATIO--ETC(U)

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Technical Report 475

NAVAL OUTGOING MESSAGE PROCESSING

A study of message generation and message preparation for transmission and the impact of automation

Naval Ocean Systems Center (Code 8125)
Marine Corps & Special Systems Branch

Final Report — December 1979

Prepared for
Naval Ocean Systems Center (Code 18)
Fleet Readiness Office

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AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

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ADMINISTRATIVE INFORMATION

This study was prepared under Naval Ocean Systems Center (NOSC) Project FN09 by members of NOSC Code 8125. Code 8125 is a branch of the Ship and Shore Communications Systems Division (Code 812) of the Communications Systems and Technology Department (Code 08) at NOSC. The study effort was conducted under the general guidance of the Navy Science Assistance Program Coordinator (NSAP) (NOSC Code 18) in response to NSAP Project SURP-1-78 tasking. This study effort took place during March through August 1978. Participating in the composition of this report were R.H. Bowser, W.D. Carpenter, G.C. Dorsey and R.P. Milne, all of NOSC Code 8125.

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This study documents some of the means and methods available to remedy the message preparation and entry problem of afloat ships and lists, with prices, for the available component terminal equipments. It proposes a modular concept that can stand alone or be integrated with any of the appropriate NAVMAC systems. It also provides guidelines for SURFPAC to evaluate various means of message entry and message processing with their associate costs.

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EXECUTIVE SUMMARY

BACKGROUND

This report is the result of a Commander, Naval Surface Force, U.S. Pacific Fleet (COMNAVSURFPAC) request to the Navy Science Assistance Program (NSAP) to study the means and methods available to remedy the message preparation and entry problem of afloat ships. The request was made also to list and to price available component terminal equipments. NSAP tasked NOSC to do this study based on previous work at NOSC in message preparation, entry and distribution. The study proposes a modular concept that can stand alone or be integrated with any of the appropriate NAVMAC systems. This study was not required to develop the ultimate answer to the message entry and processing problem, but to present a near term solution to existing problems. This study provides guidelines for SURPAC to evaluate various means of message entry and message processing with their associate costs.

OBJECTIVE AND APPROACH

- Analyze the impact of the media selection on message generation and preparation
- Analyze the impact of automation on the Naval outgoing message process
- Develop conceptual message generation and preparation systems at various levels of automation and with various choices of media
- Develop an equipment data base and project system costs

For this study the outgoing message process was segmented into message generation and message preparation (Figure 1) functions. Message generation functions (Figure 2) were delineated as:

- Rough draft
- Draft
- Edit
- Coordinate
- Chop
- Approve
- Release

Message preparation functions (Figure 3) were delineated as:

- Accept
- Prepare
- Transmit
- Backroute
- File
- Ancillary

EVALUATIONS

Message processing media were defined as the vehicle used to contain a message during transport from one message process function to another. The presently used medium is type on paper and the media chosen for evaluation were:

- Visual (type or print on paper)
- Magnetic (card, disk, cassette, etc.)
- Electric (hard wired)

The choice of media is more important to message generation than to message preparation. By definition, a fully automated message processing system would use electrical medium. This report concludes, however, a fully automated system for outgoing message processing is not as cost effective as a stand-alone system.

Thus, it was necessary to recommend media other than electrical as the choice for all but the fully automated ship. Media evaluation is summarized in Tables 1, 2 and 3. The visual media showed greater merit than magnetic and the visual media were recommended. In recommending the visual media, it is necessary to spend some time discussing the visual media reader – the optical character reader (OCR).

The OCR is available, reliable and suitable to the task of a message input device. The authors have first hand experience with tactical message preparation systems using OCR equipment for entry and have found some to be acceptable, suitable and desirable input devices. OCRs vary in their ability to read typed documents. This varying ability has to do with character contrast, line skew, character misalignment, etc. It is this qualitative characteristic of optical character reading which generates the emotionalism concerning OCRs. Attachment A to this report details the experiences regarding automated message entry system using an OCR as input device and gives numerous examples of the material (skewed, misaligned, etc.) which the OCR found acceptable.

The message generation functions did not lend themselves well to full automation and partial automation was best served by the visual media. The chop, coordinate, approval and release functions involve people and people involved need or want a hard, readable message copy to read, mark up or file. Therefore, these functions are not cost effective candidates for automation except in fully automated ships. The message composition functions (draft and edit) do lend themselves to automation assistance; this assistance is categorized as basic and advanced. The basic aids would permit changes to a message without message retype (i.e., by use of symbols and correction pages) and consist of character erase, overwrite, insert: line insert, delete and paragraph insert, delete. Recognition of symbols and action capabilities would reside in the message preparation system and would be cost effective and desirable aids to implement.

Advanced automation aids run the gamut from word search and replace or delete to input data validation and interactive prompting. These aids imply machine storage of the message with the machine providing a clean copy of the message after edit. The machines range from commercial grade "smart" typewriters ($5000) and word processing systems ($15,000) to full MIL-SPEC message composition stations and cannot be recommended for wholesale replacement of the typewriter as the prime message composition tool. It is recommended, though, that a few commercial grade smart typewriters be provided at high volume, high precedence message composition areas within the ship.

A subset of the message composition function is pro forma message composition and this area is ripe for automation. Pro forma message composition would be cost effective if automated at a single, central location as part of an automated message preparation system. The format of a pro forma message is rigidly specified. Thus, users need only to indicate the type of message desired and the data to be inserted. This would be a cost effective candidate for automation if provided in areas such as supply (MILSTRIPS) and either as a stand-alone hard copy system or electronically interfaced with an automated communication system.

Many functions in message preparation can be benefited by automation. For the most part message acceptance involves people and is not a cost effective candidate for automation. The message preparation for transmission, however, can be enhanced greatly by automation. The following tasks within this function are considered candidates for automation:

- Assign and log unique DTG
- Validate message parameters
- Determine format of delivery circuit
- Validate PLAs
- Prepare message in correct format and LMF
- Place message in proper outgoing queue

Automating these tasks will improve accuracy, save time and personnel hours and reduce personnel requirements. Automating the message transmission function requires an interconnect of an automated message preparation system to an automated communications system and the development of software to control the interface properly. The cost effective candidates for automation within the message backrouting function are:

- Determine recipients
- Duplicate, collate and slot message copies

Automation of the delivery task is cost effective only on a fully automated platform. The file maintenance function is a prime area for automation. The customer request function is a prime area for automation assistance with access to the data base being the primary task to be automated. The tedious and time consuming task of recording message statistics and making reports can be greatly benefited by automation. The file destruction function is highly dependent on the file media used and is not an area that can be enhanced effectively by full automation.

Four levels of increasing capabilities, cost and complexity for an automated message preparation system (AMPS) were formulated as a result of this study. Each succeeding level of AMPS contains the automated functions of the preceding levels, as well as additional new functions. AMPS can be incorporated into any computerized communication systems such as NAVMACS, MPAS and COMPARS.

AMPS I is defined as the basic outgoing message preparation system. It automates those functions within a communications center which require the greatest number of personnel and are characterized as being the most time consuming and prone to human error. In particular, it automates the preparation of an ACP 126 modified message for transmission. Other outgoing message processing functions are accomplished manually, semi-automatically or by systems such as the naval modular automated communications system (NAVMACS) or the message reproduction and distribution system (MRDIS).

The development of AMPS I is a low cost, low risk proposition. It automates the processing of 80 to 90 percent of the typical outgoing message traffic on a small ship and provides significant enhancement to message processing on large ships.

AMPS II is the most cost effective level of the four levels of capabilities being considered. In addition to the capabilities of AMPS I, AMPS II automates the validation of plain language addresses (PLA) and address indicator groups (AIG), message filing and retrieval functions and formatting of JANAP 128, ACP 126 messages. It is a moderate cost, low risk proposition. It automates 90 percent of the typical outgoing message traffic and is suitable for medium to large ships.

AMPS III capabilities are essentially the same as the outgoing message processing capabilities of NAVMACS V4 with MRDIS. In addition to the capabilities of an AMPS I and AMPS II, the AMPS III increases the variety of input devices, generates data pattern messages, automates some of the backrouting functions and, additionally, automates those functions typically called for in only five to 10 percent of outgoing message traffic (sectioning, segmenting, retransmitting, readdressing, etc).

The development of AMPS III is a high cost, low-to-moderate risk proposition and provides only a small increase in capability over AMPS II at a considerable increase in cost. This system is suitable for large ships.

AMPS IV, in addition to the capabilities of AMPS I, AMPS II and AMPS III, uses remotely located, networked KDTs for the message composition, staffing, releasing and delivery functions. It also uses remote LPs for electronic delivery of messages being backrouted.

While AMPS IV would automate all message preparation functions, its development is a very high cost, moderate risk proposition that is practical only on fully automated ships.

CONCLUSIONS

To provide a near term, cost effective system with minimum changes to the present method of message preparation, chop and release the paper reading, (OCR) AMPS II is determined to be the modular system that can be used as a stand-alone system or be incorporated into any computerized communication system such as NAVMACS.

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

FIGURES

TABLES

GLOSSARY

ACP	Allied Communications Publications
ADP	Automated Data Processing
AIG	Address Indicator Groups
AMAP	Automated Message Assistance Processor
AMES	Automated Message Entry System
AMPS	Automated Message Preparation System
ASCII	American Standard Code for Information Interchange
COMMANAVSURFPAC	Commander of Naval Surface Force U.S. Pacific Fleet
CMTU	Cartridge Magnetic Tape unit
CNO	Chief Naval Operations
CPU	Central Processing Unit
CSN	Channel Sequence Numbers
DAAS	DoD Automatic Addressing System
DTG	Date Time Group
EMMCT	Electrical Media Message Composition Terminal
EMMVT	Electrical Media Message Verification Terminal
FIFO	First-in-first-out
HF	High Frequency
ITA#2	International Telegraph Alphabet #2
JANAP	Joint Army Navy Air Force Publication
KDIT	Keyboard/Display Intelligent Terminal
KDT	Keyboard/Display Terminal
LMF	Language Media Format
LP	Line Printer
MCS	Message Composition Station
MDU	Magnetic Disk Unit
MED	Message Entry Device
MMMCT	Magnetic Media Message Composition Terminal
MMMVT	Magnetic Media Message Verification Terminal
MMR	Magnetic Media Reader
MPA	Message Preparation Aid

MPDS	Message Processing Distribution System
MRDIS	Message Reproduction and Distribution System
MTU	Magnetic Tape Unit
NAVCOMPARS	Naval Communication Processing and Routing System
NAVMACS	Naval Modular Automated Communications System
NELC	Naval Electronic Laboratory Center
NOSC	Naval Ocean Systems Center
NSAP	Navy Science Assistance Program
NTDS	Naval Tactical Data System
OCR	Optical Character Reader
OPEVAL	Operational Evaluation
PCR	Punch Card Reader
PLA	Plain Language Address
PTP	Paper Tape Punch
PTR	Paper Tape Reader
RI	Routing Indicator
SSN	Station Serial Number
SURFPAC	Naval Surface Force U.S. Pacific Fleet
TD	Technical Document
TEMPEST	An unclassified short name referring to investigations and studies of compromising emanations
TOF	Time of File
TTY	Teletype
USAREUR	United States Army Europe
USMC	United States Marine Corps
VMMCT	Visual Media Message Composition Terminal

BACKGROUND

This report has been prepared by NOSC Code 8125 for NSAP (Project SURP-1-78). The NSAP tasking was an outgrowth of an earlier NSAP effort (Project TH-2-75). In the earlier NSAP project a feasibility model of an automated ongoing message preparation system was installed onboard the USS OKLAHOMA CITY in April and May 1976. It used an optical character reader as an input device. The results of feasibility model testing are contained in Reference 1 and indicate a high degree of acceptance by users and a significant increase in communication center efficiency on the OKLAHOMA CITY. A subsequent request by the OKLAHOMA CITY requesting continued usage of the test system* resulted in SURFPAC direction** to study further the effectiveness and efficiency of automated outgoing message preparation systems and candidate message entry devices as applied to the shipboard message preparation process.

NOSC Code 8125 has developed significant background in the advancement of automated outgoing message preparation systems and in the use of keyboard/display terminals (KDT) and optical character readers (OCR) as message entry devices. It also has expertise in microprocessor systems, smart and dumb terminals and magnetic card, tape and disk input devices. Related efforts by Code 8125 in the field of message preparation and entry are as follows:

- OCR Selection Criteria and Equipment Survey (Reference 2)
- Feasibility Model Development of an Automated Message Entry System (Reference 3)
- USS OKLAHOMA CITY Automated Message Preparation Study and Feasibility Demonstration (Reference 1)
- Feasibility Demonstration of a Tactical Message Preparation System for USAREUR (Reference 4)
- Advanced Development of an Automated Message Entry System (AMES) for USMC (References 5 through 15)

STUDY DEFINITION

The object of this study is to analyze the outgoing message process of Navy ships and to determine which message generation and preparation functions are cost effective candidates for automation. A second object is to analyze the various media by which a message might be routed through the message generation process and to recommend the desired media and suitable message entry device(s).

As shown in Figure 1, this effort has been broken into the message entry device study and the automated message preparation system study. These are artificial and arbitrary divisions but they suit the study goals and simplify and bind the analyses. For this study, the processing of outgoing naval messages has been broken into message generation and message preparation for transmission. Message generation is the process from creation

*USS OKLAHOMA CITY has retained and continues usage of the feasibility test system; this system is presently installed on the USS BLUE RIDGE

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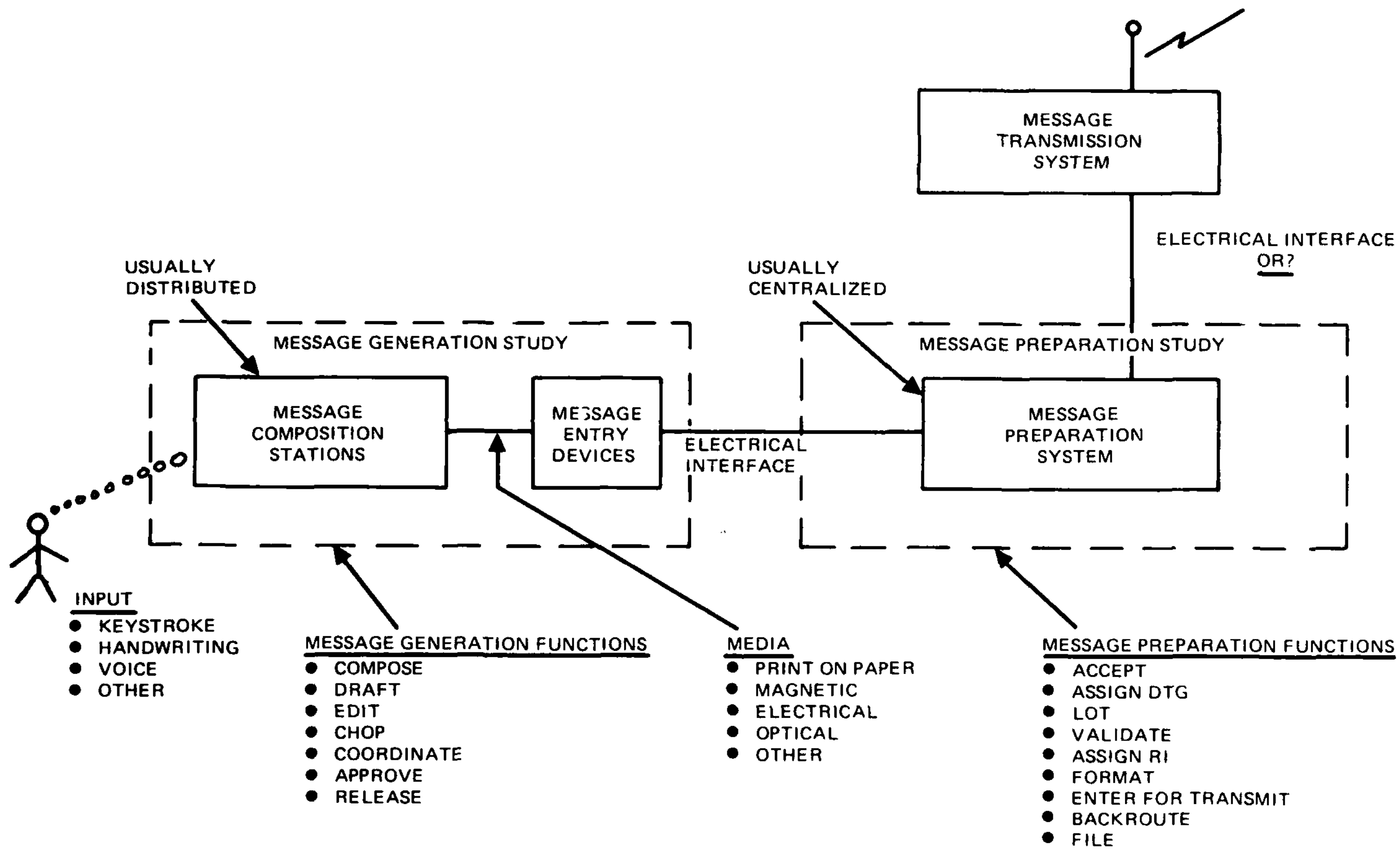

Figure 1. Outgoing naval message processing -- study definitions.

of rough drafts through command approval and release. Message preparation is concerned with actions normally taken in the communications center to ready a message for entry into the message transmission system.

As shown in the figure, possible inputs to the message composition station are voice, handwriting and keystroke (typewriter or keyboard). Voice and/or handwriting are desirable but presently not state-of-art and thus the keystroke emerges as the input of concern.

MESSAGE ENTRY DEVICE (MED) STUDY

The message entry device study concerns itself with the message composition stations to be distributed throughout a ship and the message generation process from message composition to delivery at the communications center window (or equivalent) for preparation and transmission. Message generation functions have been flowcharted as depicted in Figure 2.

A driving force in this study will be an analysis of the media used for message routing. At present this medium is paper (DD-173 forms or equivalent) and the message composition station, a typewriter. A trend toward automation would imply an upgrading to smart typewriters or even a replacement of the conventional typewriter with a keyboard/display terminal and a resultant trend toward electrical routing of messages.

Smart terminals offer up a host of message composition aids, none of which are present in the current system and many of which offer significant benefit. The media could remain type on paper or could be replaced by electrical, magnetic, paper tape or other machine readable code. It should be noted that any departure from a human readable medium results in a substantial requirement for distributed reader/displays and attendant hard copy devices. It is now, and will remain in the future, human nature for all in the process to want a personal hard copy. It should be noted further that most media dictate a continuance of the messenger/mail routing of messages for chop and release, whereas one, electrical, evokes images of a hands off, speed-of-light message transfer.

In all cases, there is a need for an automated input into the message preparation system (communications center). The present manual poking of formatted paper tapes, with its attendant errors and bottleneck at the input to communications center processing, is not tolerable. All media in question satisfy the requirement of being machine readable; however, type on paper has the advantage of being human and machine (by optical character reader) readable, thus retaining a familiar and comfortable system (minimum perturbation and user confidence). The electrical media eliminate the messenger/mail routing but at a high cost in electronics and ADP equipment (complexity).

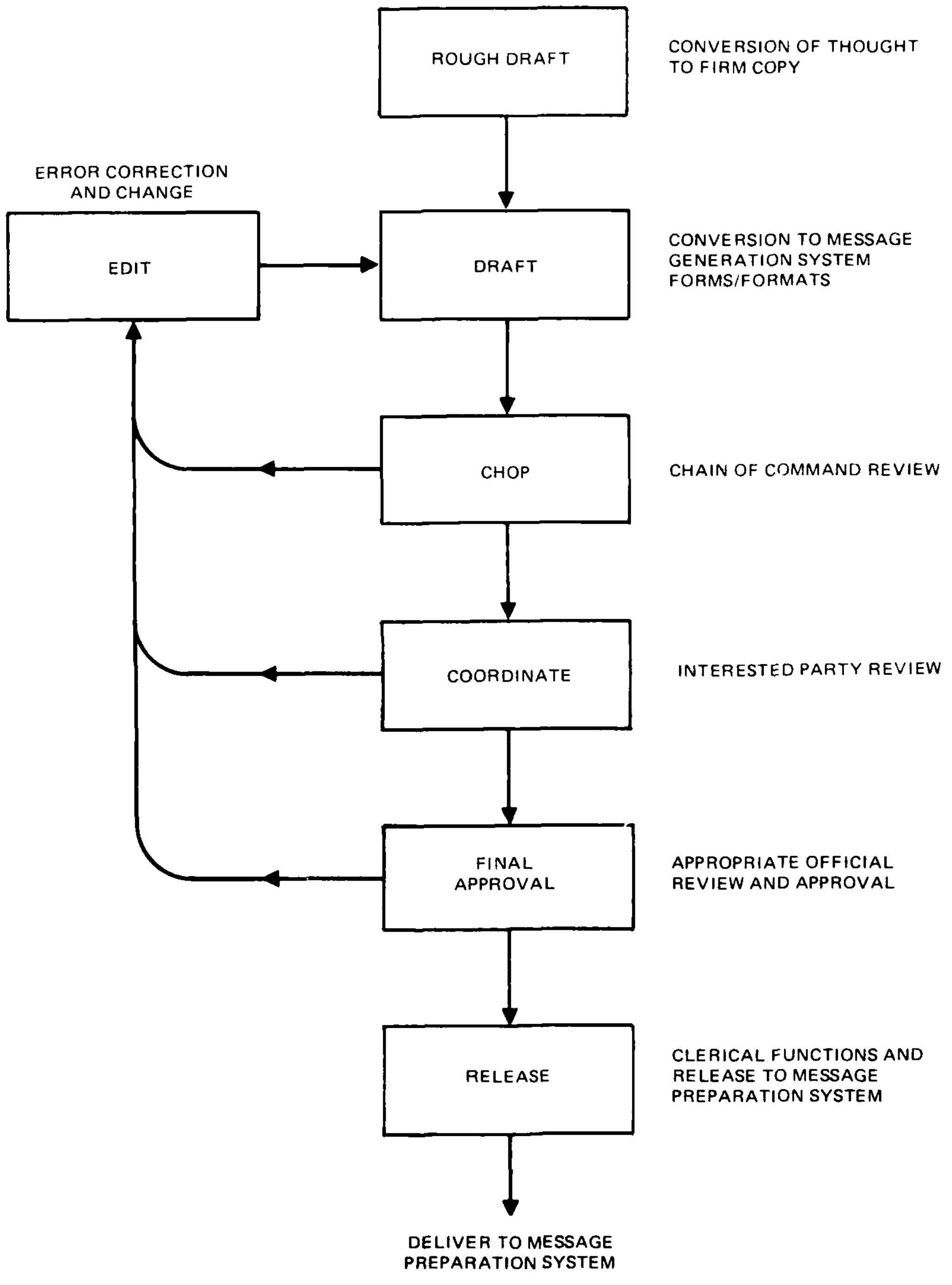

Figure 2. Message generation flow.

AUTOMATED MESSAGE PREPARATION (AMP) STUDY

The AMP study will concern itself with functions performed primarily by the shipboard communications center. These functions will be called message preparation functions and are depicted in Figure 3. Shipboard communications center functions are prime candidates for automation and several systems exist which address this area. Many data on time and error reduction are available. The time savings in hours in communication center processing is a typical result of communications center automation.* This number is reduced somewhat in significance when balanced by the overall writer-to-reader time of typical (routine and priority) Naval message processing (but during high tempo most of the formal routing and approval is skipped and the delay in the communications center then becomes very significant). Automation also reduces the number of required communications center personnel as well as message errors. It should be noted there is a growing trend toward incorporating some automated message preparation functions into the message transmission system.

*Quite often time is saved from improved message composition and entry in conjunction with automation of communications center functions.

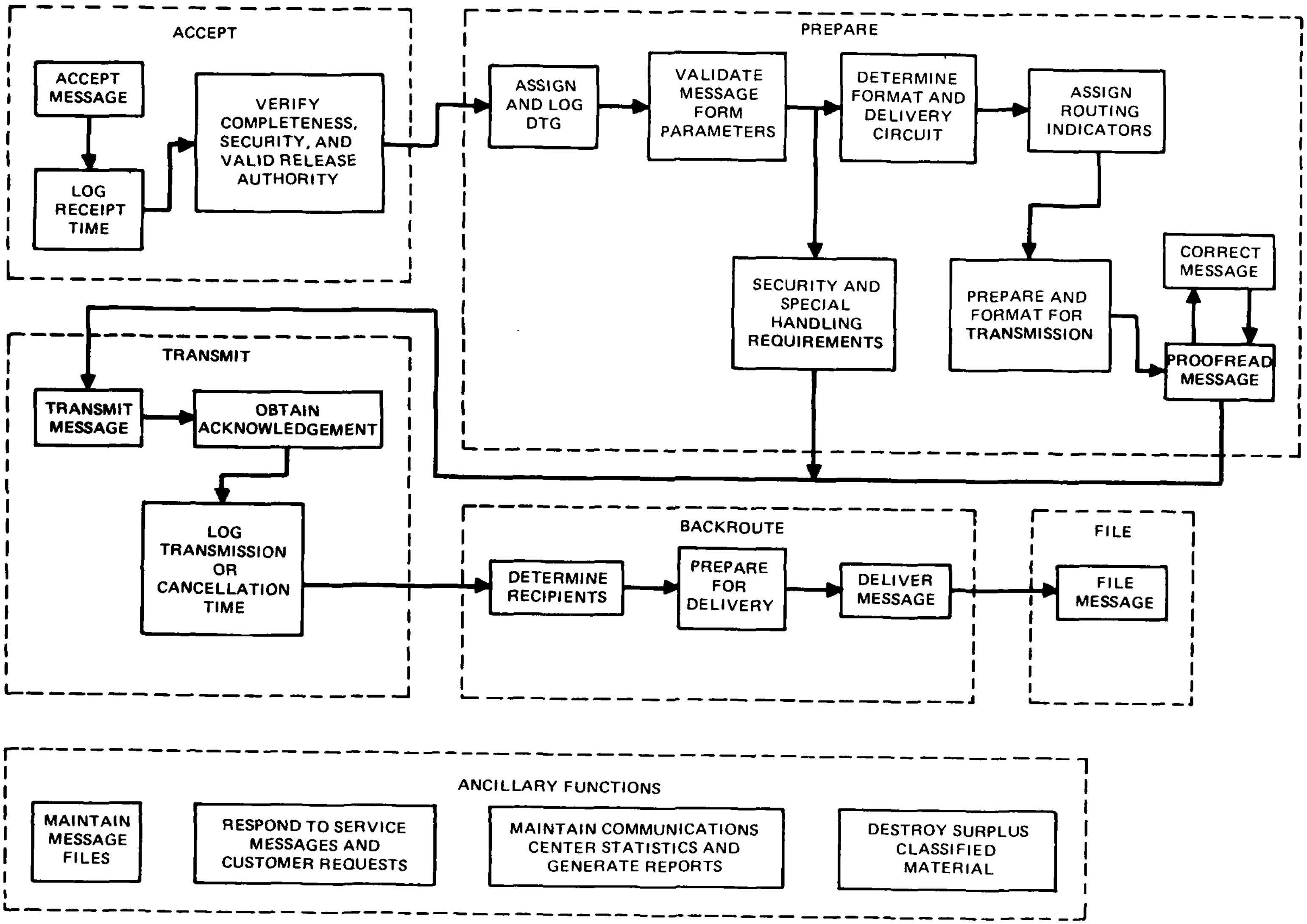

Figure 3. Message preparation functions.

MESSAGE GENERATION

Within the Navy, Chief of Naval Operations (CNO) has recently promulgated (OP-643C/LEX2D5 Ser 771307 of 16 February 1978) a set of rules for message text formatting. These rules concern themselves with the textual portion of Navy data pattern messages. The communications header portions of messages continue to be specified in Joint Army, Navy, Air Force Publication (JANAP) 128 (G) Allied Communications Publication (ACP) 127 (E).

An objective of this message text formatting, as stated in the rules from CNO, is to produce messages which are both understandable by humans and compatible with ADP. Their goal should be the goal of all future shipboard message generation and preparation systems.

MESSAGE GENERATION FUNCTIONS

For the purposes of this study the shipboard message generation functions are as depicted in Figure 3 and defined as follows.

- Rough draft: Writing down thoughts and/or data in rough form
- Draft: Preparation of a message on a medium suitable for edit, chop, coordination, approval and release
- Edit: Changing or correction of message content by deleting, adding or substituting words, phrases, sentences or paragraphs; restructuring the message content also would be an edit function
- Chop: Changes in a message by the chain of command to insure readability and conformance to proper format and content; review and approval by the chain of command
- Coordinate: Disclosure of the message to interested parties in the immediate area who need the information for planning purposes or who will be affected by the action of information contained in the message; anyone reviewing the message may suggest changes
- Final Approval: Formal authorization for message transmission by the command
- Release: Transfer of a message from the release authority to the communications center after approval; approval of a message for transmission is noted by a unique identification (i.e., signature) of a release authority

FUNCTIONS ANALYSIS

The following paragraphs concern themselves with the significant divisions of the shipboard message generation process and discuss the effect, implications and constraints of automation on this process.

Message Composition

There are several automated message generation functions which are aimed at helping the writer compose his message. These aids break into the major categories of pro forma message and narrative message composition aids.

Pro Forma Message Composition Aids

Pro forma messages include RAINFORM, weather, communications status and fuel status reports, DAAS supply messages and others whose format is rigidly specified. The structure of pro forma messages is rigidly specified so that data may be accepted by computers for automated processing. Therefore, it is necessary that the message be absolutely correct in format as well as data content. Also, the header lines are usually fixed. Thus, a message composition aid which automatically generates significant portions of pro forma messages would save time and improve accuracy. Such a device is the message preparation aid (MPA) developed and evaluated by Naval Electronics Laboratory Center (NELC) in 1973. The MPA and an evaluation is the subject of NELC TD 305 of 14 February 1974.[16] Note that pro forma message generation could be accomplished at a centralized location. The individuals responsible for generating the message need only specify the type of pro forma message and the data to be inserted.

Narrative Message Composition

Working from the assumption that the smart typewriter or a keyboard/display terminal (KDT) will replace the typewriter/message form as the tool of message composition, then there is a use and a need for narrative message composition aids. Narrative message composition aids run the range from delete and correct to spelling and syntax validation. It should be noted that it is not necessary to discuss the output (electrical, hardcopy, magnetic tape, etc.) of the KDT or its interface to the balance of the message generation process to cover the merits of the message composition aids. Distributed KDTs would imply significant capital expenditure and maintenance support costs. The smarts involved have to be provided either centrally (electrical/support requirements) or locally (increasing the cost of KDT). The implied evolution is toward an electrical interface and electrical routing through the message generation and preparation process. This would require significant changes to internal routing and approval procedures and substantial store and forward capabilities and alerts. Again, this requires significant capabilities which have to be provided for either locally or centrally.

Message Chop and Coordination

The chop and coordination functions will be performed by personnel who must be able to read the message. If the medium containing the message cannot be read, then a special reading device must be provided, e.g., a magnetic tape reader and display if the medium is magnetic tape. The chop and coordination can be done with printed copies of the message given to the appropriate people for review. After the chop and coordination processes, suggested changes can be written on copies of the message and given to the message writer who then will edit the original message. Thus, we see the "other than paper" media reverting to paper during chop and coordination and edit.

Message Approval and Release

Before the message is received by persons designated as the release authority, all chop, coordination and editing should be performed on the message. If the medium containing the message cannot be read, then a special reading device must be provided. The release authority must show approval on the medium bearing the message before releasing it to the communication center and must be completely confident that the medium contains the message in the exact form that was approved originally.

MEDIA

Media Evaluation

Message generation is done for the significant types of media. Media selection criteria are the subject of Appendix F. The type of media for message entry considered are typewritten pages, binary electrical signals and binary magnetic fields on disks, tapes and cards. The generalized model shown in Figure 4 is used to illustrate the message flow for discussion of the media.

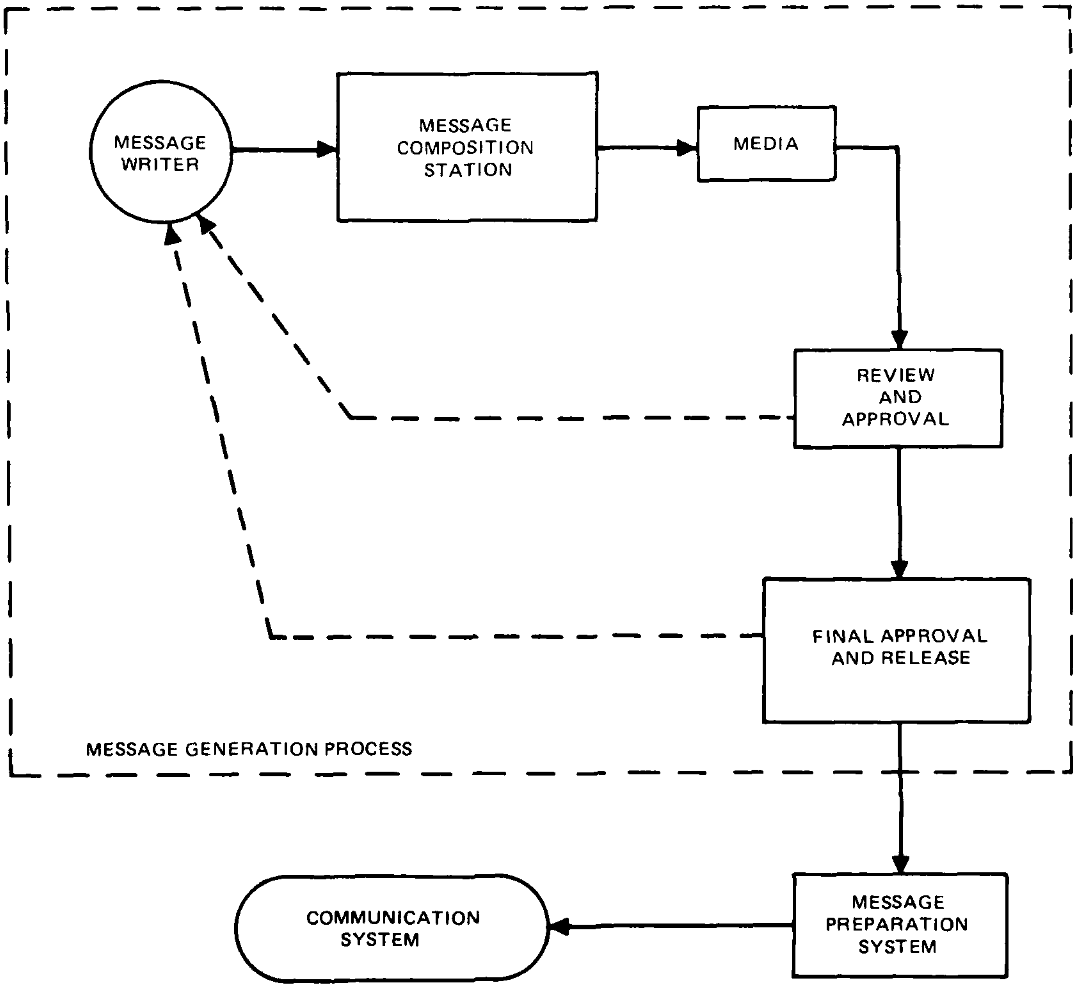

Figure 4. Message generation system model – general.

Typewritten Page (DD-173 Form)

This medium permits the appropriate people to read the message without using special equipment and facilitates coordination with those individuals concerned with the purpose and effects of the message. Since the message is printed on paper, it can be reproduced. Suggestions and changes can be noted on a paper copy of the message and returned to the message writer. The message can be carried to any place where the review personnel are located. The routing procedures and safeguards for classified message handling can be the same as for other paper documents. A message generation system using DD-173 forms as the medium is depicted in Figure 5. A message printed on a DD-173 form is readable by humans and compatible with message entry equipment when an optical character reader is the message entry equipment.

Typewriter for Message Generation

The following steps explain the flow of messages typed on DD-173 forms through the message generation process:

STEP 1. A draft message is typed and copies are given to appropriate personnel for chop and coordination.

STEP 2. The review personnel will make changes on a copy of the message and return it to the message writer or indicate that the message needs no change.

STEP 3. The message writer will make any changes on a copy of the message and give it to the typist for correction. If the typewriter has a storage device and editing functions, the typist can recall the message from storage and edit it. If a conventional typewriter is used, editing of a message is accomplished by indicating where the change is to be made and typing the desired change on a correction page. These correction pages are also readable by the OCR. Note that it is not necessary to retype the entire message.

STEP 4. Copies of the revised message are given again to the review personnel.

STEP 5. Steps 2, 3 and 4 are repeated until no changes are made and the message is ready for final approval.

STEP 6. The message is delivered to the release authority for review and signature. If the message is not released, it is returned to the message writer with appropriate explanations. The message composition process would continue at Step 3.

STEP 7. After the message is approved and signed by the release authority, it is delivered to the communication center.

Keyboard/Display Intelligent Terminal with Printer for Message Generation

There are advantages in using a keyboard/display intelligent terminal (KDIT) with a printer instead of a typewriter. They are the potentials for an extensive editing capability, memory for storing several types of pro forma messages and prompting/validation or restriction of characters entered in the message. The time required for editing a message or generating a pro forma message probably would be shorter using a KDIT instead of a typewriter. The steps explaining the generation and flow of messages using a KDIT with a printer are the same as those stated in the preceding section except the typewriter is replaced

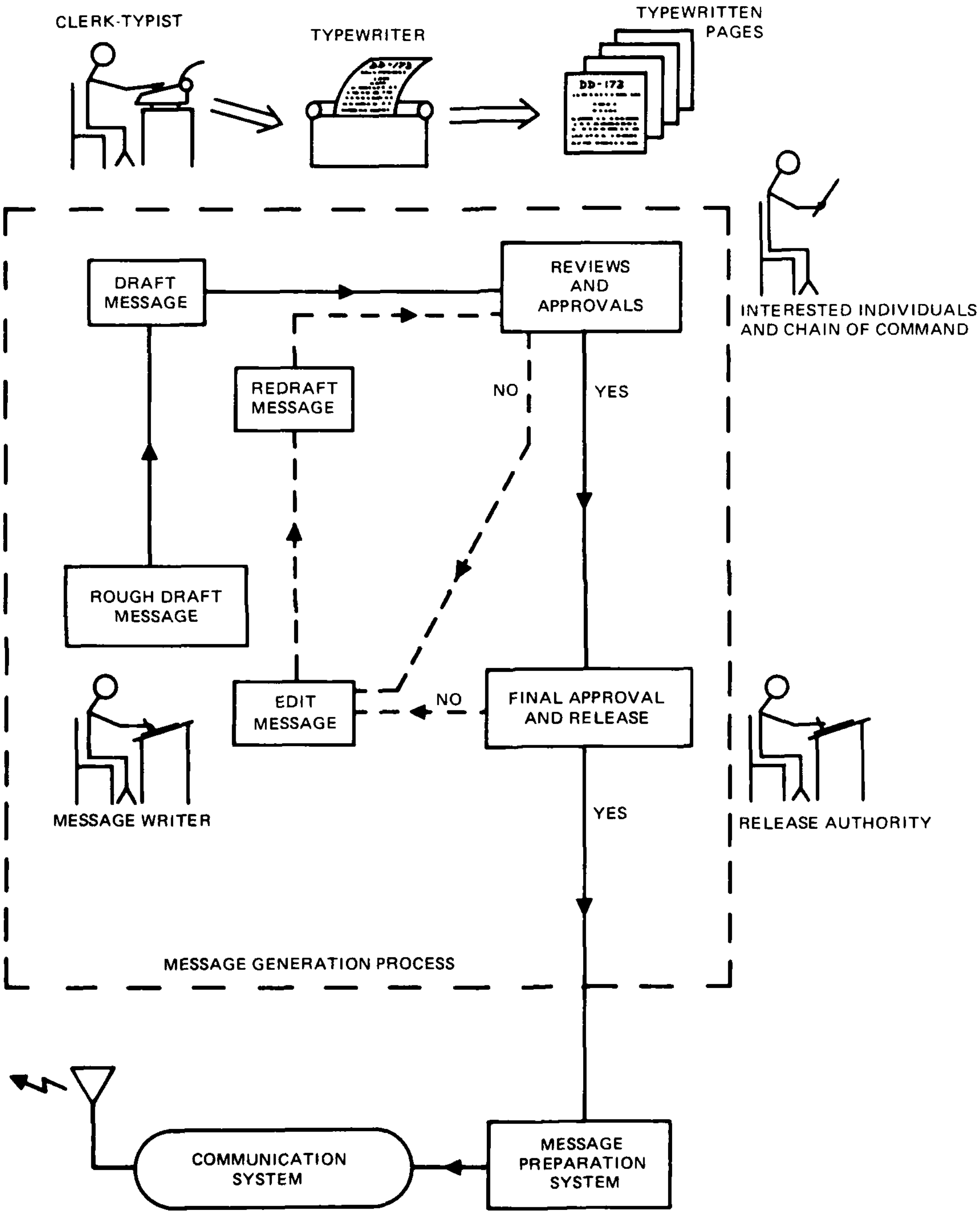

Figure 5. Message generation system model – typed DD-173 form as medium.

with a KDIT and printer. Such a system is depicted in Figure 6. The KDIT with a printer would cost considerably more than a typewr r.

Electrical Signals

This medium is compatible with message processing equipment but is not readable by humans. This medium enables a fast transfer of a message between equipments after keyboard entry. The equipment for converting the message to electrical signals is a KDIT. The features of a KDIT are the same as those stated as advantages in the preceding section. A printer would be used with the KDIT to print a copy of the message for review and editing by the people concerned with the message content. Appropriate security safeguards should be implemented to ensure that the KDIT and any personnel viewing the KDIT are cleared for a classified message. To review the message, the release authority would use the display on any available KDIT. After the release authority read and approved the message, an identification unique to each release authority would be entered after the message to show approval. After approval and release, no changes in the message content would be allowed. The following steps explain the generation and flow of messages using the electrical medium. These are shown pictorially in Figure 7.

STEP 1. The message composition station (MCS) operator will key the message into the KDIT and route electrically for reviews and approvals. Hard copies would be printed out for review by appropriate persons.

STEP 2. The appropriate review personnel will make changes on a copy of the message and return it to the message writer or indicate that the message needs no change. The review and approvals could be done either on the KDIT and routed electrically or on a locally printed copy and routed by messenger.

STEP 3. The message writer will make appropriate changes on a copy of the message and give it to the MCS operator for editing.

STEP 4. A new copy of the edited message is electrically routed for review again by the appropriate personnel.

STEP 5. Steps 2, 3 and 4 are repeated again until no changes are made and the message is ready for final approval.

STEP 6. The release authority is notified that a message is ready for approval and transmission. The release authority reviews the message on a KDIT display and enters a unique code word at the terminal to show approval. If the message is not released, the message writer should be notified via the electrical medium and the message returned to the writer with whatever explanation is appropriate. The message composition process would continue at Step 3.

STEP 7. The release authority would transfer the released message using the electrical lines to the communication center from the KDIT.

Binary Magnetic Field (Magnetic Disks, Tapes or Cards)

This medium would use a keyboard for message entry and a magnetic writing device for recording. The equipment would be a KDIT with the capability as stated in the preceding section for message generation and a magnetic write/read unit for record.ng

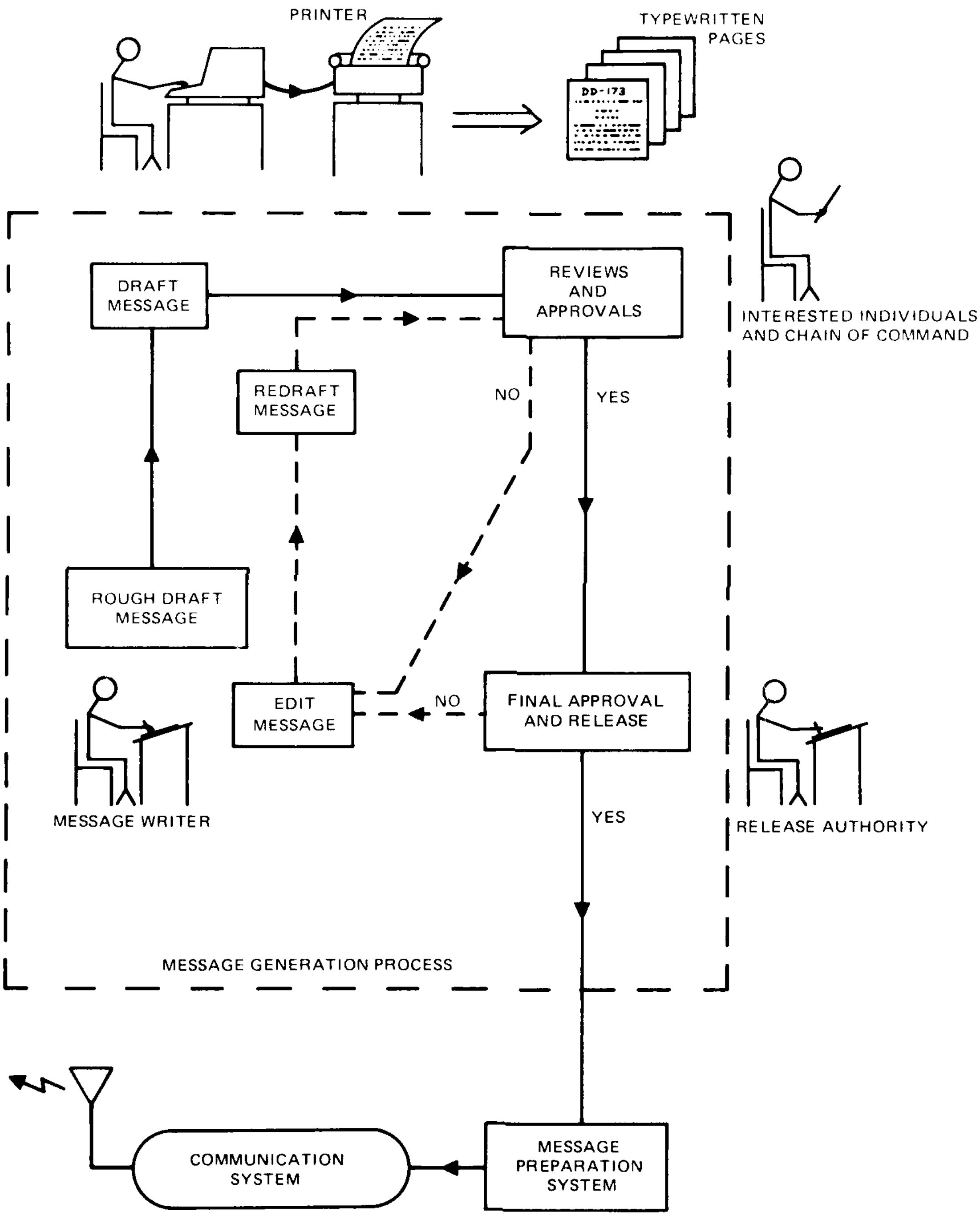

Figure 6. Message generation system model -- printed DD-173 form as medium.

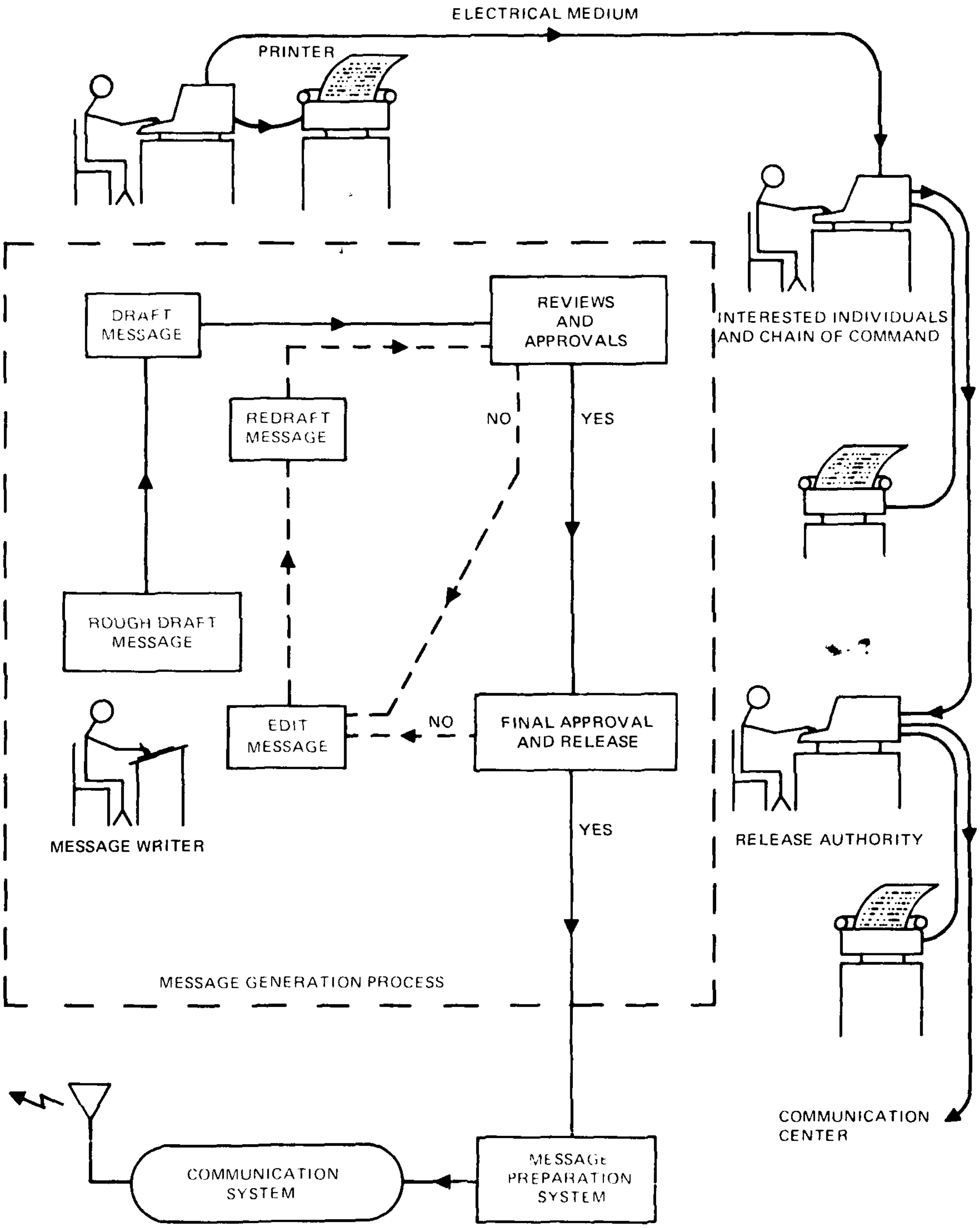

Figure 7. Message generation system model electrical medium.

on the disk, tape or card. The magnetic write/read unit could be peripheral to the KDT or integrated into the KDIT. A printer would be a necessary peripheral unit to the KDIT. Read terminals would be needed at the review and approval stations as well as available to the release authority to examine the message because the magnetic media are not readable to humans. The following steps explain the generation and flow of messages using the magnetic medium. The flow is depicted in Figure 8.

STEP 1. The message composition station (MCS) operator will key the message into the KDIT and have it written on the magnetic medium for review by appropriate individuals. The message may be stored only on the magnetic medium. Hard copies will be printed for review and approval personnel who do not have readers.

STEP 2. The appropriate review personnel will make changes on a copy of the message and return it to the message writer or indicate that the message needs no change. The changes may be made on a hard copy printed locally or a modified message written on the medium provided for review.

STEP 3. The message writer will make appropriate changes on a copy of the message and give it to the MCS operator for regeneration on the magnetic medium.

STEP 4. New copies of the edited message are rerouted again for review by the appropriate personnel. The edited message replaces the original message on the magnetic medium. Hard copies are provided where necessary.

STEP 5. Steps 2, 3 and 4 are repeated until no changes are made and the message is ready for final approval.

STEP 6. The message as recorded on the magnetic medium is delivered to the release authority for review and approval. The release authority may use a special magnetic reader or the KDIT magnetic write/read unit for displaying the message. If the message is not released, it should be returned to the message writer with whatever explanation is appropriate. The message composition process may continue at Step 3. The release authority adds a unique code word after the message and signs on the magnetic medium container to show approval.

STEP 7. After the message is approved and released, it is delivered to the communication center.

Multimedia

A multimedia system could use two media; for example, the typewritten page and binary electrical signals. The typewritten page would be DD-173 forms printed from typewriters or printer units peripheral to a keyboard/display intelligent terminal (KDIT). The message media would be as described in the preceding sections. The message composition systems would operate in parallel up to the point of message entry into the communication center.

To have a minimum delay in composing and entering a message for processing, the electrical medium would be used with the KDIT in the MCS connected directly to the message processor. The KDIT in the MCS would serve as a remote message entry terminal of the processor.

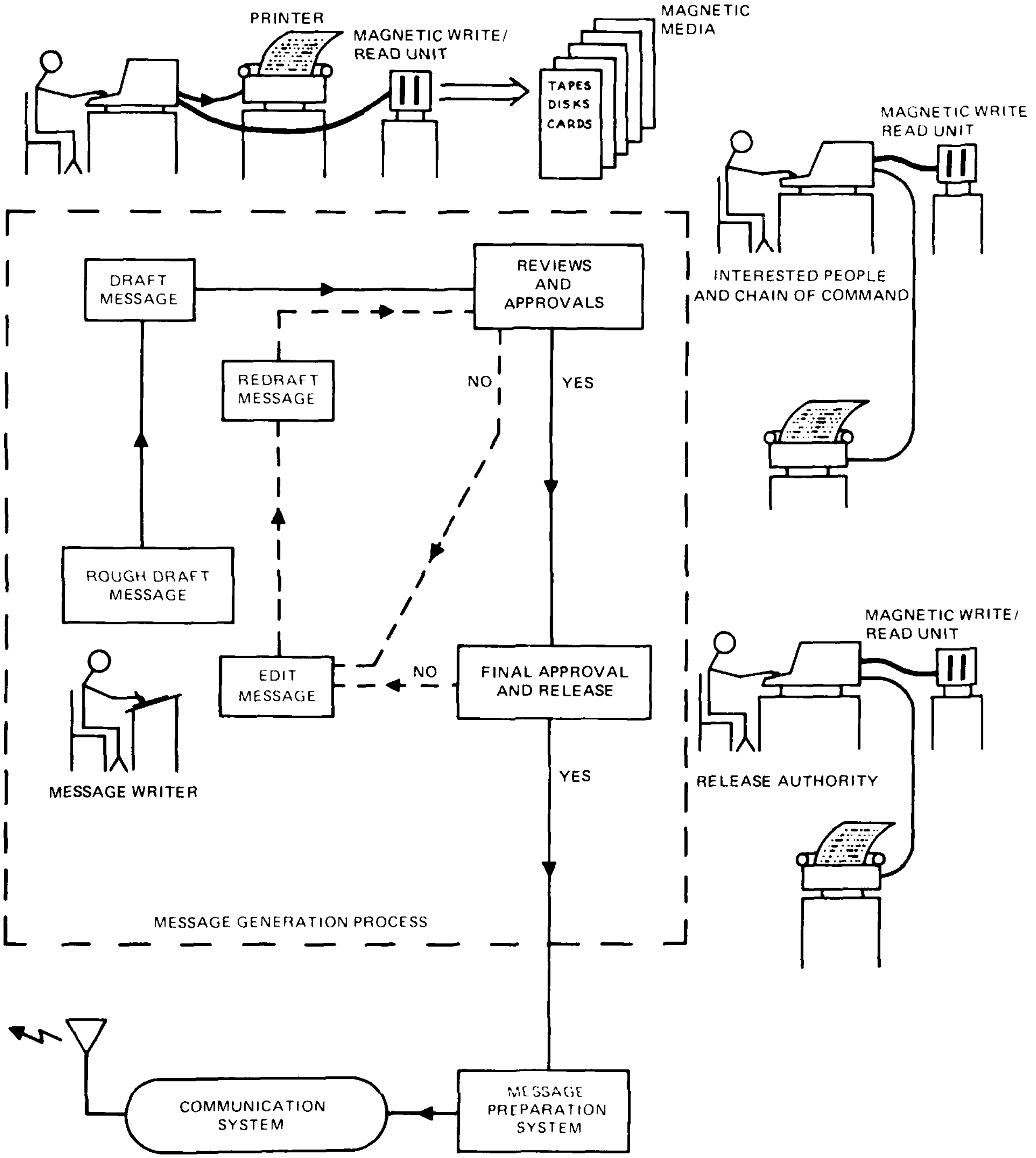

Figure 8. Message generation system model – magnetic media.

Media Evaluation Results

The media are evaluated with respect to readability by humans and machines, equipment costs for the message generation process and the number and training of personnel as discussed in Appendix F. Cost estimates of the typewritten page and magnetic media are shown in Table 4. Media costs become an important consideration if the proper security precaution is to destroy the medium after using it only once.

Table 1. Visual media (typed or printed page) evaluation summary.

No user impact as this is the present medium

- Handled like other paper documents in reference to precedence, security and routing procedures
- No special equipment, training or skills required for personnel performing message chop, coordination, approval and release functions

High user confidence

- What is read and signed is what is transmitted
- Know precedence and security with certainty

Media cost is low ($0.01 per page)

Commercial grade OCR typewriters are adequate

- Provide the basic automation aids for message composition
- No new equipment required outside of communications center if OCR typewriters already in use
- Comparatively low costs for equipment, training, maintenance and support

Message chop, coordination and approval functions are best accomplished on page media where changes can be penciled in and the original message draft can still be read for comparison

Data integrity/accuracy is not as high as with magnetic or electrical media but could be if a smart typewriter is used to generate line checksum characters during the message composition function; data integrity of OCRs is better than that provided by present manual systems

Data recoverability is high if the media are damaged

Easy to handle and is more durable than magnetic media

State-of-the-art OCRs can tolerate (within reasonable limits)

- Coffee stained, coke stained, wrinkled or dirty pages
- Smudged or touching characters
- Uneven character and line spacing
- Uneven character print density
- Variations in character stroke widths
- Cloth ribbons
- Type from manual OCR font typewriters
- Skewed and misaligned characters and lines
- Page misalignment with the typewriter

Table 2. Magnetic media evaluation summary.

High user impact: not readable by humans, require page copy and identifying labels on the media or:

- Special equipment and skills are required by persons performing message chop, coordination, approval and release functions; release authority code must be magnetically encoded on the media in addition to the usual signature on the media
- Require additional time, personnel and equipment at each stage where the message has to be read or its precedence, security and routing requirements have to be observed

Media are expensive and must be reused

- Except for magnetic cards, only a small fraction of the media unit is used for the message
- Restricted to one message per media unit to avoid conflicts during routing and approval and with both high and low precedence/security message on the same media unit
- Requires approved additional equipment and procedures to erase and verify each media unit before it is submitted for reuse

Page copy is required for chop, coordinate and approval functions as changes are not easily or effectively indicated on magnetic media

Message accountability becomes a significant problem in the communications center during times of peak loading

- Page copies or proof of transmission copies may become separated from the media unit and media are not directly readable by humans

High data integrity/accuracy through use of checksums, keying schemes, redundacy checks, etc.

Little chance of recovering the data if the media are damaged and the tendency would be to keep page copy also

High costs for equipment, training, maintenance and support

These media are best suited to mass storage of messages

Table 3. Electrical media evaluation summary.

High user impact

- Special equipment, training and skills are required for personnel performing message chop, coordination, approval and release functions
- Officers are mobile and not always near a terminal; it would be necessary for them to report to their terminals frequently to clear any pending traffic or they could be summoned by a terminal to clear a high precedence message; if this were not done, then the in basket to out basket delay would increase to that of page media and the advantage of electrical routing (high speed and elimination of messenger/mail routing) would be defeated

Electrical routing is not cost effective for low volume, low precedence message traffic unless it is part of a larger, integrated ship's command and control or management information system; quite often electrical routing is reduced in capability to being no more than an expensive electronic in/out basket; under these circumstances a cheap metal basket would be sufficient.

Page copy is required for chop, coordinate and approval functions as changes are not easily or effectively indicated on a keyboard display terminal

High data integrity/accuracy through use of checksums, keying schemes, redundancy checks, etc.

Higher costs for equipment, training, maintenance and support than would be with magnetic or typewritten page media

High cost for both terminal and system computer software to:

- Route message to the various review personnel in the correct order
- Notify review personnel of a pending high precedence message or of an excessive backlog of messages which needs to be reduced
- *Ensure that the person operating the terminal and the terminal itself* are cleared for classified messages
- Verify that a message has been completely and properly routed before it is released
- Permit only valid release authorities to release messages

Requires installation of TEMPEST approved cables

Table 4. Media cost comparison.

MEDIA	COST ESTIMATE PER UNIT	COST ESTIMATE PER 500 MESSAGES[1]
Typewritten page	$0.01/page	$10
Magnetic[2]		
5-1/4 inch floppy disk	$ 7.00/disk	$ 1,750
8 inch floppy disk	8.50/disk	2,125
hard disk	80.00/disk	20,000
tape cassette	7.00/cassette	1,750
tape mini-cartridge	18.00/cartridge	4,500
tape cartridge	19.00/cartridge	4,750
card	1.00/card	250
Paper tape[3]	$ 0.50/roll	$ 6.25
Electrical[4]	very low	very low

NOTES:

1. This roughly represents 10 days of message traffic based on USS OKLAHOMA CITY data
2. Based on one message/unit, 50 messages/day, an average message length of 2100 characters, and the medium, where applicable, is available for reuse once every five days; security problems associated with reusing the medium are not considered
3. Assumes an efficiency use of 40 messages/roll
4. One time cable installation costs will be considerable

Typewritten Page (DD-173 Joint Messageform)

This medium has the advantage of being readable by humans during the message generation process and readable by an optical character reader (OCR) for the entry into an automated message preparation system after final approval. The type style on the typewritten page would be a special font, readable by both humans and OCR units. OCR units can be programmed to read particular fonts. The selection of which type style to use is based on the ease with which humans can read the characters and the error rate associated with the OCR unit that must also read the characters. The Department of the Navy has specified the use of OCR-B (Reference 17). The DD-173 typewritten pages are not reusable, but they have a very low cost, they are plentiful and can be easily handled as with other paper documents. The equipment cost for preparing the medium at a single message composition station (MCS) is estimated to vary from $800 to $30,000 depending on the equipment used. For example, a commercial electric typewriter costing $800 may be purchased with the appropriate type style. However, the initial cost of an MCS could be lower if the shipboard typewriters presently used have a changeable type capability and the particular OCR readable type style is available for that model typewriter. Additional costs would be low also for logistic support of presently used typewriters. The equipment costs will be high for a keyboard/display intelligent terminal (KDIT) with a printer, up to about $30,000 for one MCS. There are many KDITs and printers available for the commercial market costing much less than $30,000 but these equipments are not designed for shipboard use. The costs for a fully qualified shipboard KDIT and printer may even exceed the $30,000 depending on the total capability required.

The operator for an MCS using a typewriter would need training as a typist. If the typewriter has extra editing and special features for message composition, then extra training would be required for machine operation. If a KDIT and printer are used in the MCS, then the operator skills and training time may increase greatly over that required for typewriter use. Although a KDIT with extensive editing and special capability would require more operator skills and training time than if the ordinary typewriter was used, once acquired, the training should speed the message generation process. The exact benefits of a tradeoff of message generation time for operator training time are beyond the scope of this report. The use of operator prompting by the KDIT may reduce the time required for generation of some types of messages and also may reduce operator training time. Only one trained person is required for an MCS.

There would be no equipment or training for personnel involved with chop, coordination and release of messages over what is required at present. The message review and release personnel would be able to read the message on the DD-173 form whether it is typed on a typewriter or printed from a KDIT. There would be no additional security requirements for message handling beyond those presently in use.

Electrical Signals

This medium has the advantage of having a fast transfer between equipments and compatible signals for entry into an automated message preparation system.

The use of the electrical medium aboard ship requires that TEMPEST approved cables be installed. The cables and cable installation cost, a one time cost, would be high. The location and number of message composition stations, message handling equipments and the cable routing would need to be determined before cable installation costs could be estimated adequately.

The equipment cost for a single message composition station (MCS) is estimated to vary from $5000 to $40,000, depending on the equipment used. If a commercial smart typewriter is used that has storage, edit and electrical communication capability, the cost may be as low as $5000. If a KDIT is used in the MCS, then the cost may be about $40,000 for a shipboard qualified unit. Security approved equipment and spaces would be required for each MCS.

The operator of a MCS using a smart typewriter or KDIT would need training as a typist and machine operator, as well as special training for communication control, editing and use of message composition features. The training, once acquired, should speed the message generation process. Here again, the exact benefits of a tradeoff of message generation time for operator training time are beyond the scope of this report. The use of operator prompting by the smart typewriter or KDIT may reduce the time required for generation of some types of messages and also reduce operating time. Only one trained person is required for each MCS.

The equipment cost for a single station for message chop, coordination or release is estimated to be from $5000 to $35,000, depending on the equipment used. A smart typewriter or KDIT with a printer may be used for message review and release. The review and release personnel would need training in equipment operation and communication control. Changes to a message may be noted on a hard copy or entered via the keyboard on a smart typewriter or KDIT. A hard copy may be routed back to the message writer using the same delivery system as for other paper documents or the changes entered by keyboard can be transferred electrically back to a place where the message writer can view the changes on a display or obtain a hard copy. The use of operator prompting for review and release functions when changes are entered via keyboard may reduce the time required for message correction. Security approved equipment, spaces and safeguards would be required to ensure that only authorized personnel view a message.

Binary Magnetic Field on Disks, Tapes and Cards

Magnetic disks, tapes or cards are readable by the appropriate reading device for entry into an automated message processing system. The magnetic medium is not suitable for direct reading of a message by humans but, with appropriate reading and display (or printer) devices, a message can be read from it.

Magnetic disks and tapes are best suited for mass storage of messages. The storage capacity (200 to 300 messages) of a disk or tape far exceeds the requirements for an average length message. However, a tape or disk could be used as the medium for the message generation process. The storage capacity of one magnetic card is suitable for an average length message, but several cards would be required for a long message.

The equipment cost for a single message composition station (MCS) is estimated to be $7000 to $45,000, depending on the equipment used. If a commercial smart typewriter with a magnetic write/read unit attached is used in the MCS, then the cost may be as low as $7000. If a KDIT with magnetic write/read unit and printer is used, the cost may go up to about $90,000 depending on the total capability required. Security approved equipment and spaces would be required for each MCS.

The operator of a MCS would need training as a typist and equipment operator, as well as special training for use of any editing and message composition features. Once acquired, the training in the use of editing and message composition aids may speed the message composition process. The use of operator prompting by the KDIT or smart typewriter may reduce the time required for generation of some types of messages and also reduce operator training time. Only one well trained operator is required for each MCS.

The equipment cost for a single station for message chop, coordination or release is estimated to be $7000 to $90,000 depending on the equipment used. A smart typewriter or KDIT with magnetic read/write unit and printer may be used. The review and release personnel would need training in equipment operation and possibly typing if suggested message changes are added to the magnetic medium. Changes to a message may be noted on a hard copy of the message instead of added to the magnetic medium. The use of a reading station by review and release personnel would increase the time required for message generation above what is presently used, as well as requiring operator training time. Each person needing to review or release a message would need operator training or have an operator use the equipment. This would increase the number of personnel involved in message operation. The use of operator prompting for review and release may minimize training and message generation time.

MESSAGE ENTRY DEVICES (MED)

Some of the most important characteristics of message entry devices are summarized in Appendices A through E. Also characteristics of equipment that may be used in message entry systems are compared to the MED characteristics.

Information about the equipments was taken mostly from sales and marketing brochures. These brochures do not supply all the information required, in which case the characteristics for that equipment were marked "INA" (information not available). The equipment manufacturers may be contacted to obtain the missing information.

Optical Character Reader (OCR) Characteristics and Equipments

The OCR characteristics of primary interest are cost, throughput, character recognition, page input requirements and suitability for Navy shipboard use. Characteristics and OCR equipments are listed in Appendix A.

Keyboard/Display Terminal (KDT) Characteristics and Equipments

The KDT characteristics of primary interest are the cost, keyboard capability, display features, compose and edit capability and suitability for Navy shipboard use. Characteristics and KDT equipments are listed in Appendix B.

Magnetic Device Characteristics and Equipments

The magnetic devices considered are read/write units for floppy disks and diskettes, hard disks, tape cassettes, tape cartridges and mini-cartridges and magnetic cards. The characteristics of primary interest are equipment costs, the memory capacity of each unit, interface control and information and suitability for Navy shipboard use. Characteristics and equipments are listed in Appendix C.

Typewriter Terminal Characteristics and Equipments

The typewriter terminals considered are keyboard/printer smart terminals. The characteristics of primary interest are cost, keyboard capability, print quality, compose and edit capability and suitability for Navy shipboard use. Characteristics and equipments are listed in Appendix D.

Printer Characteristics and Equipments

The printer characteristics of primary interest are cost, print quality and type styles, paper handling, interface control and suitability for shipboard use. Characteristics and printer equipments are listed in Appendix E.

CONCLUSIONS AND RECOMMENDATIONS

There is a wide variety of systems available commercially that could function as message generation stations. Unfortunately, none are approved for service use and there is little likelihood of any of them being approved in their present form. Putting any smart terminal with memory aboard a ship will require a development project. The advantages of using message composition stations are obvious, but the life cycle cost of such a terminal is difficult to analyze.

Having distributed smart and/or dumb display terminals with electrical routing provides the highest level of capability at the highest cost. If funds were unlimited this would clearly be the best choice. Such a system would cost well in excess of two million dollars each if it were programmed to a high level of capability. The use of keyboard printer remote terminals rather than keyboard displays would decrease the hardware cost involved, but would increase the software cost. The resultant cost would still be at least two million dollars each.

Other message composition stations (essentially word processing systems) based on magnetic media (e.g., key-to-disk, key-to-tape, key-to-magnetic card) can be designed with sophisticated editing packages that could do much to speed the actual typing of the message. Their cost would be in excess of $90,000 each for a system for shipboard use. The maintenance and required operator training would add to the cost.

The common electric typewriter currently in service use is by far the least expensive message composition station, but it likewise has the least capability. Typewritten pages can be used as input to automatic message preparation systems using an OCR.

It should be pointed out that the message composition, staffing and releasing functions involve mostly human functions and, therefore, are not cost effective candidates for automation. Quite often, the time spent writing the first draft, researching information, staffing the message and waiting for the message to be reviewed by the appropriate personnel greatly exceeds the time spent to put the first and any subsequent drafts on a medium suitable for staffing and delivery to the communications center. Using smart terminals (e.g., keyboard display printer terminals and editing typewriters with magnetic memory capability) to aid in producing the message on the media provides little benefit in the overall process and, thus, is not cost effective. Not only are these smart terminals extremely expensive compared to conventional electric typewriters but also the cost for maintenance, support and training is a significant expense which also must be considered.

Typing or editing a message with conventional typewriter requires very little operator training. Changes to a message are easily accomplished by indicating where the change is being made and typing the desired change on a correction page. These correction pages are also readable by the OCR. Note that it is not necessary to retype the entire message. On the other hand, smart terminals are sophisticated devices which require extensive operator training for both officer and enlisted personnel.

Using networked smart terminals is the most expensive means of message generation and delivery and is justified only on the largest and most sophisticated ships where the terminal could be used as part of a larger integrated ship's command and control or management information system. Although networked terminals would drastically decrease the transfer time between various review personnel, they would not decrease significantly the inherent delays associated with the human functions of staffing and releasing a message. In fact, unless the reviewing officers are sitting at or near their respective terminals for a major portion of their day, it would increase the "in basket" to "out basket" delay. Basically, it is much easier for a messenger to find an officer aboard ship than for a smart terminal to summon him. Another major problem and cost associated with using networked terminals is the implementation of the security safeguards required to ensure that only authorized personnel view a message.

Since it is desirable to have only the originator make changes to the message media, the copy returned to the originator for correction must show clearly where the changes were made and what the original text was. Using either magnetic or electrical media, this is extremely difficult to do in a manner that is either printable or displayable. From a human factors point of view, page copies are the only acceptable media for the chop and coordination cycle as any changes can be penciled in easily. This medium allows anyone viewing the message to easily see exactly what words or phrases were changed and what new phrases or paragraphs were added to the original draft and yet still allows the original draft to be read for comparison. This, of course, does not preclude the use of magnetic or electrical media altogether, but points out a significant advantage of page media.

AUTOMATED MESSAGE PREPARATION

This section is not concerned with the generation of a message, but only with its handling after it arrives at the communications center via either electronic or manual means. The section is divided into four subsections. The first subsection is a delineation of communication center functions required for the preparation, transmission and backrouting of outgoing Naval messages. It is an exhaustive delineation of all functions, not just those that are candidates for automation. As such it provides a standard gauge by which to judge the effects of various media and methods of automation on the message preparation process presently in use. In other words, when automating a particular communications center function, the medium used (be it electronic, magnetic or visual) will affect not only the automation of that function, but also the automation of other functions and the operation of functions not being automated. Thus, the effect of each automation candidate and its medium upon all communications center functions, needs to be considered when evaluating it against other candidates, whether or not they are automated, for automation and other media.

The second subsection considers each function defined here and discusses each with respect to whether it is a cost effective candidate for automation using available technology. This involves examining the effect of various media upon the automation of each function as well as various methods for automating the function. Each function is studied to determine if it is really necessary in an automated environment or if it could be handled automatically or eliminated altogether by the automation of another function. As discussed previously, the effect must be considered on the entire communication center operation of automating a particular function, not only from the aspect of making it easier or harder to prepare, transmit and backroute messages, but also making certain that security, precedence, routing and formatting requirements can be satisfied without serious impact. Any evaluation of the impact on a communications center as a result of automating one or more of its functions has to include the personnel impact as well as the operational impact. Ideally, automation of a function should reduce not only personnel requirements but also skill level of personnel required. In most instances the former is much easier to attain than the latter due to the inherent complexity of automated equipment. A major thrust of the development of any automated message preparation system should be to make the equipment as foolproof as possible with a tutorial equipment operation mode for training purposes. This can increase development cost significantly, but will pay off in improved operator training and in easier acceptance of the system by the operational community.

The third subsection is concerned with candidate automated message preparation systems to handle the various message media and with different levels of capability. The media considered are electrical (e.g., remote terminals), magnetic (e.g., card, disk, tape) and visual (e.g., typewritten page). Each of these media has inherent advantages and disadvantages when viewed in conjunction with the automation of communications center functions. The levels of capability will refer to the set of functions to be performed automatically by the system. The lowest level of capability consists of automating those functions deemed to be the most cost effective candidates for automation. The highest level of capability includes automating all those functions deemed to be reasonable candidates. A system of the low level would be suited to a small ship with a relatively low volume of outgoing message activity, while a high capability system would be useful on a large ship with a high volume of outgoing traffic.

The fourth subsection discusses the conclusions of this study task and makes recommendations as to further system design and development.

MESSAGE PREPARATION FUNCTIONS

This section discusses the functions performed in the typical communications center for the preparation, transmission and backrouting of an outgoing Naval message. The message preparation functions are listed in Table 5. The other half of communications center functions, the receipt and distribution of messages from external systems, is not within the scope of this report.

Accept Message

The first message processing function performed by the communications center is to accept the message for external delivery. The message is brought to the communications center message delivery window by pneumatic tubes, messenger or courier where it is checked for precedence and valid release authority and then logged. Additional checks are performed for completeness, security, legibility, authenticity, etc., before the message is filed by precedence in the preparation queues. If it cannot be prepared as drafted, coordination with the originator is required to resolve the problem.

Table 5. Message preparation functions.

I Automated message preparation

A. Accept message for external delivery via message delivery window (messenger or courier)

1. Observe message precedence and handle according to established procedures
2. Log receipt time of message
3. Verify valid release authority
4. Check message for completeness, security, legibility, authenticity, etc.

B. Prepare message for transmission

1. Assign DTG
2. Log DTG assigned (ensure DTGs are unique)
3. Validate message form parameters
   a. Action precedence
   b. Information precedence
   c. Classification
   d. From line
   e. Addressees
   f. Text
4. Determine security and special handling requirements (falls out of the normal flow of traffic; includes such things as off-line encryption)
5. Determine format and delivery circuit
6. Assign routing indicators
7. Prepare message in correct format and LMF for transmission
   a. Narrative (normally paper tape)
   b. Data pattern (normally card or magnetic tape)
8. Proofread message
9. Correct message
10. Proofread and correct message until it is determined to be correct
11. Place message in proper outgoing queue by precedence

C. Enter message into transmission system

1. Retrieve message from outgoing queue (FIFO by precedence)
2. Transmit message over proper delivery circuit
3. Obtain acknowledgement for message
4. Log transmission or cancellation time of message

D. Backroute message

1. Determine recipients

Table 5. Continued.

D. Backroute message (Continued)

2. Prepare message for delivery
   a. Duplicate appropriate number of copies
   b. Collate and staple copies
   c. Slot message copies
3. Deliver message via pneumatic tubes or messenger (communication center or department)

E. File message

1. Store proof of transmission hardcopy and paper tape of message
2. File message by originator, DTG, SSN, TOF, CSN, etc.
   a. Short term file
   b. Long term file

II Ancillary

A. Maintain message files

1. Maintain files based on originator, DTG, SSN, TOF, CSN, etc.
2. Provide hardcopy and/or paper tape of message on request

B. Respond to service messages and customer requests

1. Determine action required
   a. Correct message in file
   b. Readdress message
   c. Customer request for additional copy of a filed message
   d. Request for retransmission of missing channel number of incomplete, misrouted or missent message
2. Take action requested
   a. Retrieve required message(s) from file(s)
   b. Correct referenced message and redistribute
   c. Prepare new heading, treat as new outgoing message
   d. Reproduce and distribute additional copy
   e. Ascertain validity of missing/incomplete message
3. Prepare service message reply, if required
   a. Obtain release authority
   b. Enter message into transmission system
   c. File message

C. Maintain communications center statistics and generate reports

D. Destroy surplus classified material

Prepare Message for Transmission

The message preparation process begins with the assignment of the date-time-group (DTG). DTGs must be logged and verified to be unique. The message form parameters are then validated. This includes the action and information precedences, classification, from line, addressees and text. Examples of problems that can occur here are: information precedence higher than action precedence, invalid classification, improper use of prosigns in the addressees and the text classification not agreeing with the stated message classification. Any problems here must be resolved by the drafter. After the form parameters are validated, the format and delivery circuit must be determined. This may depend on security and special handling requirements, such as off-line encryption. All routing indicators must be assigned and validated with respect to the message classification to ensure against security mismatches. At this point, the message is ready for preparation in the proper format and language media format (LMF) for transmission. Here the message could be narrative, which is normally prepared on paper tape, or data pattern, which is normally prepared on punched card or magnetic tape. Usually the message is prepared at a teletypewriter and sent to a proofreader for verification. If the message is not correct, it is sent back to a teletypewriter operator for correction. This process of proofread and correct can go to several iterations before a correct message copy is produced. The message then is placed in the proper outgoing queue for transmission by precedence.

Transmit Message

Entering the message into the transmission system involves retrieving it from the outgoing queue. The queues are set up by precedence and the highest precedence message is retrieved first. Within a precedence queue, the messages are retrieved first-in-first-out (FIFO). Each message is transmitted over the proper delivery circuit, normally a HF or satellite relay radio link. A positive acknowledgement must be received for each message transmitted and channel sequence numbers (CSNs) must be updated. After transmission, the transmission or cancellation time must be recorded for message accountability.

Backroute Message

Backrouting of the message after transmission is an important function of the communications center. The drafter always wants proof that the message sent is transmitted and wants a copy of it as transmitted for the drafter's files. Also, messages are normally identified by the DTG assigned by the communications center and the drafter must be given this information. The recipients of a backrouted copy must be determined and an appropriate number of copies duplicated, collated, stapled and slotted for delivery via pneumatic tubes, messenger or courier.

File Message

In addition to backrouting, a proof of transmission hard copy and paper tape of each message must be filed for later use. These copies would be used later if a message was required to be transmitted or addressed. The messages are filed by originator, DTG, station serial number (SSN), time of file (TOF), and/or channel sequence number (CSN). Normally, two message files are used, a short term file and long term file. The short term file generally contains only those messages transmitted during the previous 30 days; the long term file may hold a message copy for a year or more.

Perform Ancillary Functions

In addition to the normal functions of message acceptance, preparation, transmission, backrouting and filing, a ship's communications center typically performs other functions. These ancillary functions are to maintain message files, respond to service messages and customer requests, maintain communication center statistics and generate reports and destroy surplus classified material.

File Maintenance

Both short term and long term message files must be maintained and updated periodically to eliminate old messages from the long term file and to transfer out of date messages from the short to the long term file. Communications center personnel must be able to retrieve messages from either short or long term files based on some combination of important message parameters such as originator, DTG, SSN, TOF, CSN, etc. Retrieved messages are usually provided in the form of a proof-of-transmission hardcopy and/or the actual paper tape of the message entered into the transmission system.

Customer Requests

A ship's communications center must respond to service messages and customer requests. Requests may be made to correct a message in the file, readdress a message, provide an additional copy of a message or to retransmit a missing, incomplete, misrouted or missent message. The communications center responds first by retrieving the required message from the file and then by performing the actions requested. The action performed may be to correct and redistribute the referenced message; prepare a new heading and treat as a new outgoing message, if a message is being readdressed; reproduce and distribute an additional copy; or ascertain the validity of a missing/incomplete message. Also, it may be necessary to generate a service message reply. If so, it must be handled and processed as a normal message including obtaining a proper release authority.

Record Keeping and Reporting

For accountability purposes, message statistics are maintained by the communications center. These statistics are used in generating offship reports or messages and include, at a minimum, the total number of messages transmitted, the total number of messages cancelled or rejected, the existence of any large outgoing queues and the loss of any processing capability. More detailed statistics may be maintained for on-ship reports. These reports are used for historical and statistical analysis purposes. On-ship reports typically include measurement of system throughput performance and a statistical analysis of message precedence, classification and length as related to circuit, throughput times and accuracy.

File Destruction

Destruction of surplus classified material in a communications center is an important and necessary function. The long term message file is usually purged annually to make room for more recent messages. Excess hard copies and paper tape copies are sometimes generated during the message preparation process. All of this classified paper material, as well as the other forms of classified material such as punched cards, magnetic media/electronics and typewriter ribbons, must be properly destroyed.

NAVAL MESSAGE PREPARATION FUNCTIONS ANALYSIS

Each function delineated in the preceding section is discussed here in the context of its suitability for automation and the effect of different automation methods and media upon the ability of the communications center to perform the function. Each function is discussed also in the context of the automation of other areas and the effect of the media on performing the function if it is not automated. The intention here is to determine a kernel set of functions, which can be automated for various media at a minimal cost. These functions should be automated in any message preparation system developed for the fleet. A system designed to perform this set of functions would be suitable for a small to medium size ship with a moderate outgoing message traffic load and would have a high performance/cost ratio. As more functions are added to the kernel set, more capability is required of the supporting automated system, and the cost and complexity rises. At a certain point, adding additional functions causes a rapid increase in cost and complexity with relatively little increase (or perhaps a decrease) in operational capability. After the kernel set is determined, additional sets of functions of higher cost/performance ratios can be specified. Systems to perform these additional functions automatically, in addition to those of the kernel set, could be justified only on ships with heavy loads of outgoing traffic. Automation of functions usually results in previously unrealizable added benefits at little or no additional cost. During this analysis, added capabilities will be discussed that do not exist in the present manual system.

Message Acceptance

The acceptance of a message by the communications center for external delivery is a function that can not be automated easily. It is possible to automate various subfunctions depending on the media chosen. The primary subfunction or steps considered here are the logging, verification of release authority, special handling for precedence and the check of the message for validity. The analysis will discuss each media candidate with respect to each of these steps.

Magnetic Card Media

The use of magnetic cards as message input media does allow some limited automation of the message acceptance process, but complicates the process somewhat. Assume we use a magnetic card holding up to 50 lines of text, generated by a separate composition system centrally located or located in several of the ship's areas. The cost, of course, of multiple sophisticated magnetic card message composition stations for a single ship would be significant.

Acceptance of the message by the communications center would be complicated by the fact that the magnetic card is not visually readable and any long message would require more than one card. If the cards are to be reused, the drafter would be restricted from writing on the card with a pen or pencil to identify it. If the cards are not to be reused, their cost (estimated at $1 each) would be prohibitive. Thus, either a paper copy of the message would have to accompany the magnetic card(s) to the communications center, or at each stage where the message must be visually inspected, a magnetic card reading station would have to be provided with a display and/or printer for output. The use of a paper copy of the message attached to the magnetic cards by some method would raise the possibility of mismatching page copies with magnetic copies either at the composition station or at the communications center. At a busy communications center handling hundreds of messages a day, this could be a significant problem, especially at times of peak loadings when 200 or more messages may be received in an hour. This would be compounded by a message that may require two or more cards. If the second card of a message is misplaced, verifying which one of the several hundred in the communications center is the right one would be a time consuming task as they are not readable visually. This problem of message accountability is a problem common to all magnetic media (card, tape cassette, disk). Special procedures and equipment would be required within any communications center using magnetic media as the prime message input media.

A device could be placed at the message delivery window to log the message, verify its release authority and sort it according to precedence. The logging could be done on the card magnetically, on a separate medium, or both. Verifying the releasing authority would have to be done by assigning each releaser code to be placed magnetically on the message card. This would require the releaser to have his own card reader/writer terminal where all messages would have to be reviewed. Security procedures, to ensure that only the releaser would be able to encode the release authority on the card, would have to be formulated and implemented. Sorting the messages according to the precedence could be done easily by a reading station at the message window, but this is not a significant problem in the present manual system.

It would be very difficult to automate using magnetic cards or any other media to check the message for completeness, security, legibility, authenticity, etc. This is one function that requires a human to inspect the message visually. The use of magnetic cards would complicate the performance of the function by communications center personnel because a read station is required to verify the contents of the card. Since there is no guarantee that identifying information written on the label of a magnetic card agrees with the data written magnetically on the card, either this condition is going to have to be accepted as a risk that will have to be taken, or reading stations will have to verify the contents of message cards at various stages. This is a particular problem when verifying a valid release authority if this is not done by a magnetic code. To be reused, the card must be large enough for several signatures or have labels that can be peeled off. Neither of these solutions will provide the same level of accountability as the present manual system with each typewritten page used and signed only once.

Another problem with magnetic cards is that they are relatively fragile compared to the page copy presently used in the message preparation process. Magnetic cards do not respond well to bending, folding, spindling, scratching or other forms of mutilation that are not uncommon. When a card is rendered unreadable, this necessitates a fallback to the page copy for a retype. This would require a composition station in the communications center to redraft the message. This redraft is not presently required and would detract from the advantages of automated message preparation.

Magnetic Tape Media

The magnetic tape media available are the cartridge, mini-cartridge, cassette and mini-cassette. All have sufficient storage capacity for any anticipated message and differ primarily in size and cost (estimated at $7 to $19 each). Due to their cost, they must be reused and thus they share the disadvantages of the magnetic card with respect to accountability. They also are bulkier. Reusing the magnetic media will require security procedures to be established and implemented to ensure no classified data are subject to compromise.

The magnetic tape media also are not visually readable and thus would require multiple read stations in the communications center to verify their contents. Magnetic tapes are not as fragile as magnetic cards, but would still require special handling both inside and outside of the communications center.

The primary advantage of magnetic media is that they are easily read by electromechanical means. By the use of checksums, keying schemes and redundancy checks, the integrity of data can be checked easily. Thus there is little possibility of any unintentional changes being made to a message after it has been released. Using magnetically coded release authority, changes to a message can be effectively prohibited after its release. Unless there is a failure in the reading equipment, the drafter can be assured that exactly what was coded on the tape will be transmitted. Due to the fact that humans now do the vast majority of ships message preparation, the present system always admits the possibility of unintentionally changing a word or phrase in a message that could significantly alter its interpretation by the recipient. This problem can be effectively eliminated through automation.

Visual Media (Typewritten Page)

The typewritten page (DD-173 or equivalent) is the medium presently used for shipboard message preparation. Automation using page copies would require the use of an optical character reader (OCR). These devices presently have wide use in banks, publishing companies, newspapers, etc., as well as in shore based communications centers. OCRs require the use of special OCR typewriter fonts that are presently available only on electrical typewriters.

The use of page media would have no effect on the present communications center function of accepting the message for external delivery as they are the present media used. Automatically logging the receipt time of a message could be done using OCRs, but would require an extra reader at the message delivery window and is not likely to be worth the cost.

Electrical Media

Message delivery to the communications center via electronic means would allow the same level of automation as magnetic media. This assumes the use of multiple intelligent terminals at various locations on a ship. Their cost alone would preclude their use on any but the largest and most sophisticated ships where they could be used as part of a larger integrated ships command and control or management information system.

Electronic delivery would certainly speed the delivery of a message to the communications center. However, it would require security procedures to encode the valid release authority on the message. The TEMPEST considerations of having these terminals generate top secret or secret messages and transfer them to the communications center electronically could make the cost of these prohibitive on any ship. This approach would have by far the greatest impact upon existing ships procedures and require extensive training of ship's personnel to use the intelligent terminals effectively.

Conclusions

The functional area of the communications center that accepts messages is not an area ripe for automation. As mentioned previously, the use of magnetic or electronic media would complicate the acceptance process by requiring new security procedures to verify a valid release authority. Automating the acceptance function does not appear to be cost effective and any automation of other functions should strive to impact on this function as little as possible.

Message Preparation

The function area where the media information is converted into a format that can be transferred to existing transmission systems to be sent to external addresses can benefit greatly from automation. Here the medium is either visual, magnetic or electrical and the information is formatted into either JANAP 128, ACP 127 or ACP 126 (modified). It is transferred electrically to a transmission system (e.g., NAVMACS) or transferred to paper tape for delivery over existing transmission facilities.

The message preparation is relatively unaffected by the message media chosen. The first step would be to convert the message into binary data via some sort of reader or input device. Thus the main media consideration for this function is how reliably and easily may they be converted into binary electrical data. If the media are electronic, they are already in the proper form. Magnetic media are easily converted into binary electrical data. This conversion can be made quite reliable through redundancy and data checks, and keys can be encoded to ensure data integrity. Visual media in the form of a typewritten page can be read reliably using the proper typewriter font and an OCR. Using conventional typewriters, checksums and other such datachecks is not easy to do on an OCR. There is little possibility of an OCR matching the levels of data integrity that can be achieved using magnetic or electrical media. Normally, OCR errors are either rejects or substitutions. Rejects must be corrected by the operator, whereas substitutions are not detectable. Substitutions are, however, only character errors, not word or phrase errors. OCRs are now reliable enough to have specifications of no more than one substitution in 1,000,000 characters. This is much better than the present combination of manual preparation and message transmission via radio. Taken in this context, substitutions are not considered to be a serious problem.

Using intelligent typewriters for message generation, an OCR could closely approach the data integrity of magnetic readers. To do this the typewriter would calculate and place a line checksum character in one of the margins. This could be done at the time the final clean copy is produced. This would solve the substitution problem but would defeat a major advantage of OCRs over magnetic media: The OCRs require no new sophisticated equipment outside of the communications center, while magnetic or electrical media both require expensive terminals at various locations on each ship.

The steps for the message preparation function that could be automated in the communications center are:

1. Assign and log unique DTG
2. Validate message form parameters (e.g., precedence, classification, originator, addressees, text)
3. Determine format and delivery circuit
4. Assign routing indicators as needed
5. Prepare message in correct format and LMF
6. Place message in proper outgoing queue by precedence (on-line interface only)

An automated message preparation system proposed for shipboard use should be able to perform these steps to at least a limited degree, as they are well suited to automation. A major advantage in automating these steps is that automation eliminates the manual prepare (reformat/retype), proofread and correct steps of the present method. These steps are the most time consuming and require the most personnel training, as well as being very fertile areas for errors.

Message Backrouting

The automation of the message backrouting function can be done on a fully automated message processing system where it can be combined with the routing of incoming messages. Automating this function would be possible only on large ships where such an expensive system can be justified. Such a system would use electronic media for message delivery to the communications center. This hardware then would exist already for backrouting (i.e., keyboard displays and printers) and it would require only the generation of control software to automate the backrouting function. The main problem with this type of system is the cost. The capability provided could be very useful, but it is questionable that the incremental increase in capability is worth the great increase in cost over less costly systems with less capability based on other media.

Magnetic media would allow a form of automated backrouting as the messages could be duplicated automatically on cards and manually distributed. Marking the cards for proper delivery would be a problem and would probably require a separate sheet to identify the recipients. It would require reading stations to be available to everyone receiving a backrouted copy. Having more than one message per magnetic media unit (card, tape or disk) would be a problem, so the major advantage of magnetic storage (i.e., data compression) would be largely defeated. Due to this a page copy of the message would be far more practical for backrouting in this case as it is more compact and easily readable.

Use of OCRs would not affect the backrouting function, so any automatic or semi-automatic backrouting system presently considered for shipboard use (e.g., message reproduction and distribution system (MRDIS)) would be compatible with OCRs.

Message Filing

Maintaining outgoing message files is a relatively easy task if an automated message preparation system is used. For large systems, the files can be maintained on magnetic disk (30 days traffic). Small to medium size systems would operate best with magnetic tape storage. The tradeoff is in the area of cost/performance as disk units are very expensive compared to tape units, while for the extra money, they deliver much faster performance. Disk units can retrieve messages in milliseconds, while tape units may require minutes to perform the same task. It is likely that in the future, advanced technologies such as bubble memory will replace all disk and tape units. These technologies will be totally electronic with no moving parts. Presently, they are too expensive for mass storage use, but their cost is expected to be competitive within the next ten years. Their primary advantage is minimal space requirements with almost total reliability.

Customer Requests

The responding to customer requests, whether from tenant or from external commands, is a fertile area for semi-automation. Most customer requests require only the manipulation of the data contained in the message file and, therefore, the access of the data base is the primary area to be automated.

Requests from external commands normally involve service messages that notify the communications center of a communications problem. This involves either the reject of a message due to a format error or the garbling of a message due to radio interference. The response would be the correction and/or retransmission of the subject message. The use of an automated message preparation system should practically eliminate message rejects, thus reducing retransmission requirements. Through the use of a keyboard display terminal or an operator's console on the message preparation system, an operator could recall the message from the message file and either retransmit it via the automatic transmission system or output the message on paper tape for delivery via another circuit. The operator also should have the capability to generate short messages at the console. This could be to generate service messages or high precedence traffic in emergency situations.

Requests from tenant commands are usually for a message copy or to readdress a message in the communication center files. These could be done automatically or semi-automatically. The readdress request could be prepared on the normal input media and processed as a regular message. In this case, the message preparation system would recognize the request, search its files and readdress the message as per the request. If the message is not contained in the files, of course, the operator would have to intervene. Semi-automatic operation could be done by the operator requesting a papertape copy of the message from the message files, preparing a new header via the message preparation system and then splicing the two together and transmitting the resulting message.

Maintain Statistics

The compilation of message statistics is a time consuming but necessary task performed by the communications center. These statistics would include, but not be limited to, the number of:

1. Messages transmitted and received broken down by precedence
2. Line blocks transmitted and received
3. Cancelled messages
4. Rejected messages

Using automated message processing, these statistics can be updated easily on a real time basis and output on request to an operator's console or printer.

Destroy Surplus Classified Material

There is little possibility that increased automation would have a significant beneficial impact in this area. As mentioned previously, the use of magnetic and electrical media raise serious security problems. All classified data on a piece of magnetic medium, or contained in the memory of an intelligent terminal, must not be subject to compromise. The more intelligent terminals and magnetic media stations there are on a ship, the more of a problem this becomes.

Message Preparation System Rating Criteria

As can be seen from the preceding sections, the problem of how to best automate the outgoing message process function is not a simple one. The impact of each facet of the system's design on ships' operation needs to be examined and evaluated. Many systems look very promising in the initial proposal stage but would create hosts of administrative and operational problems if implemented in their entirety.

The problem of evaluating different system approaches and media boils down to deciding what are the important criteria for differentiating between systems and approaches. During this period of skyrocketing costs and limited defense budgets, total system cost must be considered as well as the cost-to-performance ratio. Realistically, the Navy must do a better job on a severely restricted budget, and cannot afford the luxury of multimillion dollar high performance message processing systems on every medium to large size ship. Therefore, the primary criterion must be to gain a maximum benefit in decreased writer-to-reader time using a minimum amount of hardware (i.e., money).

The second most important criterion must be the impact of the proposed system upon the present manual message preparation and transmission system. This covers many of the hidden costs and benefits of implementing a new system. Ideally, automating message preparation should have no negative impact on ships' operations. The operational community is reluctant to change procedures in any way that may shift burdens from one department to another. Thus, systems that impact the least must be considered more desirable than those with heavy impact.

Another criterion is to have a system that is easily developed. This involves the hardware, software, documentation and training courses required for a particular system. This, of course, is related to the cost and impact discussed above, but the primary emphasis here is on the risk and size of the project. The risk factor in a project generally rises faster than the project's relative magnitude and depends on how much of the project requires developing new hardware or software that has no close analogy in existing systems. A message preparation system development could be structured to be a low risk effort.

MESSAGE PREPARATION SYSTEMS

Most of the outgoing message preparation functions discussed previously are candidates for automation. Some functions are relatively easy and inexpensive to automate and provide a very significant improvement in communications center efficiency (i.e., reduced message preparation time, errors and personnel/skill levels). Other functions are relatively more difficult and expensive to automate and would be justified only for very large ships. Eventually, a point is reached where automation of some functions is no longer cost effective and provides little improvement in overall communications center efficiency. This is particularly true of those functions required in the processing of less than five percent of the total number of outgoing messages.

AMPS Functional Capabilities

Four levels of increasing capabilities, cost and complexity for an automated message preparation system (AMPS) are discussed next. Succeeding levels contain the same automated functions as earlier ones, as well as additional new functions. Hardware configurations and extimated hardware/software costs are listed for each medium type within each AMPS level. The media types considered are magnetic (e.g., card, tape, disk), visual (e.g., typewritten page) and electrical (e.g., remote dumb or smart terminal).

AMPS I

AMPS I is defined as the basic outgoing message preparation system. It automates those functions within a communications center which require the most personnel and are characterized as being the most time consuming and prone to human error. In particular, it automates the preparation of a message for transmission. Other outgoing message processing functions are accomplished manually, semi-automatically or by systems such as the naval modular automated communications system (NAVMACS) or the message reproduction and distribution system (MRDIS).

The capabilities required of an AMPS I are:

1. Input messages:

- Automatically read a DD-173 (or equivalent) formatted message via a magnetic media reader (card, tape, disk) or OCR (Typed DD-173).
- Automatically read a paper/mylar tape message prepared in DD-173 (or equivalent) format and coded in either ASCII or ITA#2. This is intended primarily for a fallback mode of operation.
- Accept multipage messages of less than seven pages prepared in DD-173 (or equivalent) format on the keyboard display terminal (KDT). This is intended primarily for high precedence traffic in emergency situations or as a fallback mode of operation. The main function of the KDT is to serve as the operator's console.
- Accept multipage messages of less than seven pages prepared in DD-173 (or equivalent) format on a remote KDT. The function of the KDT is to serve as a remote terminal for message composition, review, release and delivery of high precedence traffic from a secure space.

2. Automatically check/validate header and classification information input in 1 above. When validation errors are detected, an indication is displayed to the operator and controls are provided for manual correction when authorized.

3. Automatically assign the date-time-group (DTG), station serial number (SSN) and/or time of file (TOF), or accommodate manual assignment via the KDT as selected by the operator. Ehsure automatically assigned DTGs are unique.

4. Automatically format the data resulting from 1, 2 and 3 above into ACP 126 modified plaindress or abbreviated plaindress message format as selected by the operator.

5. Automatically output the formatted message:

- Electrically over a cable to NAVMACS
- On paper/mylar tape from the paper tape punch (PTP) in either ITA=2 or ASCII codes.

6. At the option of the operator, the message being processed is listed on the line printer (LP) for a proof-of-transmission copy and/or a journal record of important message parameters is listed for accountability and logging of message traffic.

7. Automatically compile message statistics indicating numbers of messages processed by precedence and classification and number of messages cancelled or rejected. Output these statistics to the LP when requested by the operator.

8. Permit editing of header line information via the KDT upon request.

9. If an OCR is the primary message input device, permit automatic editing of a typed DD-173 message form on a line group basis through use of a typed DD-173 correction page.

10. Provide query/response interaction with the operator. The KDT displays instructional messages identifying key selectable options.

11. Provide both on-line and off-line system self-test features to aid in fault isolation.

12. Semi-automatically section the message in accordance with the selected message format.

AMPS II

AMPS II is the most cost effective level of the four levels of capabilities being considered. In addition to the capabilities of an AMPS I, AMPS II automates routing indicator (RI) assignment for plain language addresses (PLA) and address indicator groups (AIG), message filing and retrieval functions, and formatting of JANAP 128, ACP 127 and ACP 126 messages.

Specifically, AMPS II has the following additional capabilities:

1. Automatically check/validate addressee and classification information contained in the input format. When validation errors are detected, an indication is displayed to the operator and controls are provided for manual correction when authorized.

2. Automatically assign a RI to each PLA according to the security classification level and the format of the message. Inhibit RI assignment for PLAs designated to be serviced by mail or courier. Provide the operator with the capability to correct a misspelled PLA via the KDT.

3. Automatically assign the required RIs to a minimum of 5 AIGs.

4. As selected by the operator, automatically format the input message data into either plaindress or abbreviated plaindress for one of the following message formats:

- JANAP 128
- ACP 127
- ACP 126

5. Automatically create a history file containing a complete copy of all messages transferred to NAVMACS and/or PTP as well as a journal file for accountability and logging of message traffic. The history file and the journal file should be maintained as separate storage files.

6. Provide non volatile file storage for a minimum of 200 50-character PLAs, each of which may have two 7-character RIs (primary and security alternate) along with a security indicator for each RI.

7. Provide non volatile file storage for a minimum of five 50-character AIGs and associated RI lists. A RI list for an AIG may contain up to 500 RIs. Storage for a minimum of 500 seven-character RIs is required.

8. Load or update (operator selectable) the PLA/RI and/or AIG/RI data source file from the paper tape reader (PTR) or KDT in an off-line mode.

9. On request, output the PLA/RI and/or AIG/RI file:

- To the LP in alphabetical order
- To the PTP (either ASCII or ITA#2) in a format suitable for loading the data source files as specified in 8 above.

10. Provide off-line message retrieval from the history file and output the retrieved message to the LP and/or PTP as requested. Messages are retrieved based on any one or any combination of DTG, SSN and TOF.

11. Provide off-line retrieval from the journal file to obtain a hardcopy printout of an entire day's log.

12. Provide the capability to add, where authorized, message handling instructions to the message header format lines.

AMPS III

The capabilities of AMPS III are essentially the same as the outgoing message processing capabilities of NAVMACS V4 with MRDIS. AMPS III has the capabilities given below in addition to those previously listed for AMPS I and AMPS II:

1. Automatically read a DD-173 (or equivalent) formatted message via a punched card reader or a magnetic media reader (input device may be remotely located).

2. Accept multipage messages of any length prepared in DD-173 (or equivalent) format from an additional local KDT (not the operator's console).

3. Ensure all assigned DTGs are unique, including those assigned manually by the system operator and those appearing on the message input media.

4. Automatically assign a RI to each PLA according to the LMF of the message and the delivery circuit required for transmission.

5. Automatically segment the message in accordance with the selected message format.

6. Automatically section the message in accordance with the selected message format.

7. Automatically add message handling instructions to the message header format lines based on the routing information contained in the PLA/RI and AIG/RI files.

8. Automatically convert the input message data into ACP 126 modified or JANAP 128 data pattern format upon request.

9. Automatically determine format and delivery circuit and place the formatted message in the proper outgoing queue by precedence.

10. Automatically retrieve the formatted message from the outgoing queue (first-in-first-out (FIFO) by precedence) and transmit over the proper delivery circuit. Obtain acknowledgement for the message and log the transmission or cancellation time.

11. Provide the capability for modifying and automatically retransmitting a message contained in the history file.

12. Provide the capability for automatically readdressing a message contained in the history file.

13. Retrieve messages from the history file based on any one or any combination of DTG, SSN, TOF and originator's PLA.

14. Automatically compile detailed message statistics for the purpose of automatically generating on-ship and off-ship communications reports or messages.

15. Using the input message data, automatically fill in the blanks of preformatted messages. Provide non volatile storage for a minimum of 50 canned messages with an average length of 1500 characters. Generation/maintenance of the canned messages is performed from the additional local KDT.

16. Automatically determine recipients of backrouted message from the input message form.

17. Automatically prepare copies of messages to be backrouted. This includes duplicating the appropriate number of copies and collating, stapling and slotting the message copies.

AMPS IV

Basically AMPS IV has the same outgoing message processing capabilities as the NAVMACS V5 with MRDIS or the message processing and distribution system (MPDS). AMPS IV utilizes remotely located, networked KDTs for the message composition, staffing, releasing and delivery functions. It also uses remote LPs for electronic delivery of messages being backrouted.

AMPS IV has the following capabilities in addition to the capabilities of AMPS I, AMPS II AND AMPS III:

1. Accept multipage messages of any length prepared in DD-173 (or equivalent) format from:

- Two local KDTs
- Eight (maximum) remote KDTs

Besides composition of narrative and pro forma messages, the remote KDTs also may be used for message staffing, releasing and delivery functions and for requesting additional copies of messages contained in the history file.

2. Automatically accept messages for external delivery that are generated at remote KDTs. This includes observing message precedence and handling according to established procedures, checking to ensure that the message has been properly staffed, checking for a valid release authority and logging the receipt time of the message at the communications center.

3. Automatically distribute/deliver backrouted message copies and requested message file copies to the proper remote LPs (13 LPs maximum).

4. Provide the required security safeguards to ensure that remote KDTs and LPs are cleared to handle classified messages and to ensure that only authorized personnel view a message.

AMPS Cost Comparisons

Table 6 lists the general types of equipment used in an AMPS along with the nomenclature of equipment approved for service use and the estimated cost of the equipment. For comparison purposes, Tables 7 through 10 list the hardware configurations and estimated hardware and software costs for each media type within each of the four AMPS levels. Only equipment costs and software development and documentation costs are shown. Since system costs incurred outside as well as inside the communications center are dependent on the media chosen, the costs for message composition stations are shown also. Costs for detailed system design, assembly, installation, documentation, OPEVAL, maintenance, support, training, etc., are unknown. It should be noted that these costs increase exponentially as system complexity increases.

The estimates presented in this section do not compromise a proposal. Instead, they are meant to serve only as a basis for comparing the relative complexities of the different AMPS levels and the impact of the media used. Due to the increased system complexity brought about by using electrical media, costs for electrical media are not shown except in AMPS IV. Using magnetic or visual media in AMPS IV essentially reduces it to an AMPS III level of capability.

Table 6. AMPS equipment list.

Equipment Type	Characteristics	Nomenclature	Cost
Central processing unit (CPU)	8-bit computer with 64K of ROM/RAM memory 6 input/output (I/O) ports		$ 30K
CPU	16-bit computer with 64K of ROM/RAM memory and 7 I/O ports	AN/AYK-14(V)	60K
CPU	32-bit computer with 128K of core memory and 1 I/O controller	AN/UYK-7	550K
CPU	32-bit computer with 208K of core memory and 2 I/O controllers	AN/UYK-7	865K
Keyboard display terminal (KDT)		AN/USQ-69	16K
Paper tape reader/punch (PTR/R)		RD-397/U	17K
Line printer (LP)		TT-624(V)/UG	23K
Cartridge magnetic tape unit (CMTU)	Contains four cartridge drives	AN/USH-26(V)	23K
Magnetic tape unit (MTU)	120 inches per second; four reel-to-reel tape drives	RD-358	125K
Magnetic disk unit (MDU)	Contains four drives	RD-281/UYK	400K
Punched card reader (PCR)			20K
Optical character reader (OCR)			50K
Magnetic media message verification terminal (MMMVT)	Smart terminal with keyboard, display, magnetic media device, CPU and validation software		66K
Electrical media message verification terminal (EMMVT)	Dumb terminal with keyboard and display; used only with AMPS IV due to complexity of using electrical media	AN/USQ-69	16K

Table 6. Continued.

Equipment	Characteristics	Nomenclature	Cost
Magnetic media message composition terminal (MMMCT)	Smart terminal with keyboard, display, printer, magnetic media device, CPU and editing and release authority control software		$ 89K
Visual media message composition terminal (VMMCT)	Electric typewriter with 10 and 12 character pitch, OCR-B font and once-only polyethylene ribbon	Selectric II	1K
Electrical media message composition terminal (EMMCT)	Dumb terminal with keyboard, display and line printer; used only with AMPS IV due to complexity of using electrical media	AN/USQ-69 TT-624(V)/UG	39K
Magnetic media reader (MMR)			20K
Message reproduction and distribution system (MRDIS)			125K

Table 7. AMPS I hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K	1	$ 30K	1	$ 30K		
CPU, AN/AYK-14(V)						
CPU, AN/UYK-7, $550K						
CPU, AN/UYK-7, $865K						
KDT, AN/USQ-69, $16K	2	32K	2	32K		
PTR/P, RD-397/U, $17K	1	17K	1	17K		
LP, TT-624(V)/UG, $23K	1	23K	1	23K		
CMTU, AN/USH-26(V), $23K						
MTU, RD-358, $125K						
MDU, RD-281/UYK, $400K						
PCR, $20K						
OCR, $50K			1	50K		
MMMVT, $66K	1	66K				
EMMVT, AN/USQ-69, $16K						
MMMCT, $89K	2	178K				
VMMCT, SELECTRIC II, $1K			4	4K		
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K						
MMR, $20K	1	20K				
MRDIS, $125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		366K		156K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		200K		200K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		566K		356K		

*Unknown

Table 8. AMPS II hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K						
CPU, AN/AYK-14(V)	1	$ 60K	1	$ 60K		
CPU, AN/UYK-7, $550K						
CPU, AN/UYK-7, $865K						
KDT, AN/USQ-69, $16K	2	32K	2	32K		
PTR/P, RD-397/U, $17K	1	17K	1	17K		
LP, TT-624(V)/UG, $23K	1	23K	1	23K		
CMTU, AN/USH-26(V), $23K	1	23K	1	23K		
MTU, RD-358, $125K						
MDU, RD-281/UYK, $400K						
PCR, $20K						
OCR, $50K			1	50K		
MMMVT, $66K	1	66K				
EMMVT, AN/USQ-69, $16K						
MMMCT, $89K	3	267K				
VMMCT, SELECTRIC II, $1K			6	6K		
AN/USQ-69, EMMCT, TT-624(V)UG, $39K						
MMR, $20K	1	20K				
MRDIS, $125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		508K		211K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		400K		400K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		908K		611K		

*Unknown

Table 9. AMPS III hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K						
CPU,AN/AYK-14(V)						
CPU, AN/UYK-7, $550K	1	$ 550K	1	$ 550K		
CPU, AN/UYK-7, $865K						
KDT, AN/USQ-69, $16K	3	48K	3	48K		
PTR/P, RD-397/U, $17K	1	17K	1	17K		
LP, TT-624(V)/UG, $23K	1	23K	1	23K		
CMTU, AN/USH-26(V), $23K						
MTU, RD-358, $125K	1	125K	1	125K		
MDU, RD-281/UYK, $400K	1	400K	1	400K		
PCR, $20K	1	20K	1	20K		
OCR, $50K			1	50K		
MMMVT, $66K	2	132K				
EMMVT, AN/USQ-69, $16K						
MMMCT, $89K	6	534K				
VMMCT, SELECTRIC II, $1K			12	12K		
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K						
MMR, $20K	2	40K	1	20K		
MRDIS, $125K	1	125K		125K		
COST SUMMARIES						
BASIC SYSTEM HARDWARE		2014K		1390K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		1500K		1500K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		3514K		1890K		

*Unknown

Table 10. AMPS IV hardware and software costs.

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K						
CPU,AN/AYK-14(V)						
CPU, AN/UYK-7, $550K						
CPU, AN/UYK-7, $865K					1	$ 865K
KDT, AN/USQ-69, $16K					3	48K
PTR/P, RD-397/U, $17K					1	17K
LP, TT-624(V)/UG, $23K					6	138K
CMTU, AN/USH-26(V), $23K						
MTU, RD-358, $125K					1	125K
MDU, RD-281/UYK, $400K					1	400K
PCR, $20K					1	20K
OCR, $50K						
MMMVT, $66K						
EMMVT, AN/USQ-69, $16K					2	32K
MMMCT, $89K						
VMMCT, SELECTRIC II, $1K						
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K					8	312K
MMR, $20K					1	20K
MRDIS, $125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE						1977K
SOFTWARE DEVELOPMENT AND DOCUMENTATION						3000K
SYSTEM DESIGN						*
SYSTEM ASSEMBLY						*
SYSTEM INTEGRATION AND TESTING						*
SYSTEM DOCUMENTATION						*
SYSTEM INSTALLATION						*
LIFE CYCLE SUPPORT						*
HARDWARE AND SOFTWARE COSTS						4977K

*Unknown

MESSAGE PREPARATION SYSTEM EVALUATION

The message preparation system rating criteria gave a basis for evaluating different system and media approaches. This section deals with analyzing each system and media approach with respect to those criteria. For ease of discussion, the performance levels of message preparation systems are discussed separately in the following paragraphs.

AMPS I Evaluation

An AMPS I would be suitable for a ship with low to moderate outgoing message requirements although it also could be used effectively on a large ship with heavy outgoing message loads. It would automate the preparation of ACP 126 (modified) format messages for transmission to NAVCOMPARS. It would have no ACP 126, ACP 127 or JANAP 128 capability, nor would it have magnetic storage for history or journal files. The message output would be either on paper tape or directly to a transmission system such as NAVMACS. Even at this capability level, it is expected to handle 80 to 90 percent of the outgoing message requirements of its target platform.

Of all the functions involved in generating, staffing and preparing an outgoing message for transmission, automation of the message preparation function provides the greatest improvement in communications center efficiency and the greatest decrease in writer-to-reader times. A drastic reduction in message preparation time and errors occurs when message parameter validation, formatting, tape cutting, proofreading and correcting are either automated or eliminated. Tape cutting (retyping of the message), proofreading and correcting are all redundant steps since these were also done before the message was delivered to the communications center. Another benefit of automatic message preparation is the reduction of personnel and skill level requirements within the communications center. Even with these reductions the communications center maintains the capability to handle a large increase in the number of outgoing messages with no increase and little or no backlog of messages. Operational data documenting the benefits of automatic message preparation are contained in References 1 and 3.

Performance/Cost

AMPS I, being a relatively moderate performance candidate, must have a correspondingly low cost to justify its use. In this case, the magnetic and electrical media based systems are at a severe disadvantage because they require expensive remotely located message preparation terminals. Page media using OCRs can be implemented using low cost electric typewriters. Performancewise, a major advantage of magnetic and electrical media based systems is their editing capability. But this capability is not cheap. With the addition of memory to an electric typewriter, the editing capability can be achieved for page media at a much lower cost than distributed display terminal or magnetic card/tape/disk terminals. A major advantage of networked smart terminals is their capability for speed-of-light delivery. Using one or two remote terminals for the composition and delivery of high precedence messages becomes cost effective for most ships if all review, approval and release functions are done at the composition terminal and if the terminal is located in secure spaces where only authorized personnel are permitted to view classified messages. Essentially, the remote terminal is just another means of inputting messages into AMPS which is located in the communications center. A remote terminal used in this manner provides the ship's commander with a near real-time message generation and delivery capability for record communications.

From the standpoint of basic cost, page media is the best choice for AMPS I. In conjunction with a single remotely located video message composition and entry terminal, it yields a high level of performance at a reasonable cost.

Impact

The impact of systems based on magnetic media upon the present message composition and preparation process would be significant. This mainly is due to the fact that the media are not readable by humans and require many reading terminals. These terminals must be documented and supported. Schools to train maintenance personnel would have to be developed, not only for the message preparation system, but also for the remote message composition and review stations. As discussed in the previous section, security procedures to deal with the storage and reuse of the magnetic media would have to be formulated and promulgated. The impact of these could be significant upon ships operations.

Magnetic, electrical and, to a lesser extent, page media would have a beneficial impact upon the data integrity problems of the present message process. This is due to the inherent machine readability of the media. No human translation is required to change the typewritten message into an electrical signal for broadcast over a radio or landline. Thus, whatever is typed is going to go out as is, with no chance of an inadvertent human error in preparing the message.

Page media would have the most beneficial impact upon operator training, as it require the simplest equipment suite and the least change in present communications center procedures. The main benefit here would be in the area of reduced need for paper tape preparers. For electrical and magnetic media, this would be offset largely by the operator and maintenance personnel and training required.

Ease of Development

As far as ease of development is concerned, none of the proposed capabilities of AMPS I would be a technical risk. The technology to implement them exists and is state-of-art. The OCR based system would be easier as it requires less basic hardware for a given performance level. A commercial OCR could have to be certified for shipboard use or militarized as none exists now. This is also a problem with respect to magnetic media as the present military inventory of service approved magnetic media units is limited and expensive.

AMPS II Evaluation

An AMPS II would be suitable for a medium to large ship with moderate to heavy outgoing message requirements in a variety of formats. It would handle narrative traffic in ACP 126, ACP 126 (modified), ACP 127 and JANAP 128 formats. In excess of 90 percent of the outgoing message requirements could be handled by this type of system with little or no manual intervention. The primary limitations on this level of system are that it does not handle data pattern traffic nor does it automatically handle messages requiring sectioning or segmenting. These can be handled semi-automatically using minimal manual intervention.

Performance/Cost

SMPD II is a relatively high performance system that can still yield a very high performance-to-cost ratio. As in the case with AMPS I, page media would be by far the least expensive media to use as the primary input. Magnetic and electrical media require expensive terminals outside of the communications center, putting them at a severe cost disadvantage. These media would be cost competitive if each terminal could be procured for $5K or less. Considering the present cost of relatively unsophisticated militarized ADP equipment (e.g., AN/UYK-20 mini-computer, $60K; AN/USH-26 cartridge magnetic tape unit, $23K; AN/USQ-69 keyboard video display, $16K, etc.), it is highly unlikely that any sophisticated terminal could be procured for less than $30K each. The cost could be as much as $100K each. Page media require only the electric typewriters currently used on most ships.

Impact

The impact of this type of system would be much the same as for AMPS I. Beneficial impacts would include drastically reduced message preparation time and reduced personnel requirements. Page media would have the least negative impact as they require only a slight modification of existing procedures. Magnetic and electrical media would have a heavy impact as they require a revamping of existing procedures. As electrical and magnetic media require more hardware, their maintenance cost would be higher than page media. Security procedures to ensure no compromise of classified information would be much more difficult than for page media.

Ease of Development

Technology exists to implement an AMPS II. There are no significant areas that are stumbling blocks to fielding such a system. Electrical and magnetic media based systems would, however, require the development of a remote terminal or terminal multiplexer. Page media would require the militarization of an OCR for shipboard use.

AMPS III Evaluation

An AMPS III would be a high performance system suitable only for a large ship with heavy outgoing message requirements. It would handle all traffic that an AMPS II could handle, plus be able to handle data pattern traffic, pro forma message generation and automatically section or segment messages. In short, it would do everything but automate the backrouting, review and release functions. For all practical purposes, such a system could handle all of the expected outgoing traffic.

Performance/Cost

AMPS III would be a high performance, high cost system. Its ratio of performance/cost would not be as great as that of AMPS II, as it handles only an additional 10 percent of the message traffic, while its cost would be far greater than AMPS II. As one considers systems of higher and higher cost, the choice of media becomes less and less a significant factor. An extra $200,000 added to a $1,000,000 system is not nearly as great as $200,000 added to a $100,000 system. However, even for AMPS III, page media would still be less expensive on both an initial procurement and life cycle cost basis.

Impact

The impact of AMPS III would be much the same as AMPS II. Its beneficial impact would be slightly higher due to its greater capability. Its negative impact would be minimized by the use of page media instead of magnetic or electrical media.

Ease of Development

The technology exists for developing an AMPS III, but the task would not be an easy one. The processing power required would necessitate using an AN/UYK-7 computer or possibly networked AN/UYK-20 minicomputers. The task of developing the software to handle the sophisticated message processing requirements of an AMPS III would be a multimillion dollar and multiyear effort. Networking minicomputers would be less expensive with respect to hardware cost, but would complicate the required software, making it harder to develop.

AMPS IV Evaluation

An AMPS IV would have all the capability of an AMPS III plus automate the backrouting, review and release functions. This would be a highly capable system that essentially would automate totally the communications center outgoing message process. It would be practical only for large ship applications where its capabilities were felt to be essential.

Performance/Cost

Even taking into consideration the high performance capabilities of an AMPS IV, its cost would be correspondingly high and give it the lowest performance/cost ratio. The additional capabilities of this system over those of AMPS II or AMPS III are high cost items. At this stage the media essentially are electrical, although magnetic and page media could also be used. A system of this level of complexity would be much more reasonable if it were a subsystem of a much larger system that would control all facets of a ship's operations; in other words, a fully automated ship. As a stand-alone system it is too expensive.

Impact

The administrative and operational changes required by this level of system would be significant. Operator and maintenance personnel training would be most costly for this level. The security procedures necessary to ensure the integrity of classified data displayed at remote terminals would have a serious impact on normal day-to-day operations. Displays would have to be shielded electronically as well as from inadvertent visual disclosure. The message composition review terminals would be integral parts of the ship's operations and would require the officers to report to their terminals at designated intervals to clear out any pending messages. By their very nature, the terminals would be complicated to operate and would require the officers and enlisted personnel to have extensive training to use them effectively. Also, due to the large amount of electronic equipment required for an AMPS IV, the lifecycle maintenance costs are hard to estimate, but would likely require several maintenance technicians.

Ease of Development

An AMPS IV, with its very sophisticated capabilities, would be moderately risky to develop. The ramifications of the use of this type of systen are widespread and affect many facets of ships operations. A great deal of system development time and money would have to be spent on the quality assurance of such a system to ensure that it would work as advertized and be accepted by the operational community as an asset rather than a liability. Far too often, systems have been touted as the "greatest thing since steam and cheap too," only to be found to fall far short of goals and requirements by the time they reach the OPEVAL stage.

CONCLUSIONS AND RECOMMENDATIONS

Automating or semi-automating the message composition and preparation process is not simple. In this age of limited budgets, the Navy must concentrate on maintaining a lean, effective fighting force on a minimal amount of money. Cost effectiveness is more important now than ever, and any high cost system comes under very close scrutiny, irrespective of its performance capabilities. In this atmosphere it is not possible to recommend the development of either an AMPS III or AMPS IV. The cost is too high and the relative improvement over an AMPS II is marginal at best. The Navy would be better off to push for the development of a relatively inexpensive AMPS II or AMPS I that would yield a significant increase in capability over the present manual system at a relatively modest cost.

Among the media choices available, page media in conjunction with an OCR is clearly the most reasonable choice based on its low cost alone. The fact that it also causes minimal impact upon the present manual system, while still allowing the automation of the most time and personnel-consuming functions of the typical ship's communications center, makes it a clear favorite. OCR technology is now at the stage where page media can seriously challenge magnetic media in the domain of machine readability, and greatly improve the present system based on reading by humans. This is done without reducing the information to a form that is unreadable by the human eye.

REFERENCES

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2. AMES OCR Selection Study, 17 September 1974, NELC Code 3200.

3. Field Evaluation of the AMES Feasibility Model, 7 May 1976, NELC Code 3200.

4. CINCUSAREUR HEIDELBERG, GE 140920Z, October 1977.

5. General Description of the AMES ADM 31 March 1978, NOSC Code 8125.

6. Operators Manual for the AMES ADM, 31 March 1978, NOSC Code 8125.

7. Maintenance Manual for the AMES ADM, 31 March 1978, NOSC Code 8125.

8. Equipment Supplement for the AMES ADM, 31 March 1978, NOSC Code 8125.

9. Functional Operation Specifications for the AMES ADM, 31 March 1978, NOSC Code 8125.

10. Program Performance Specifications for the AMES ADM, 31 March 1978, NOSC Code 8125.

11. Program Design Specifications for the AMES ADM, 31 March 1978, NOSC Code 8125.

12. Program Design Notes for the AMES ADM, 31 March 1978, NOSC Code 8125.

13. System Specifications (Type A) for the AMES, 31 August 1978, NOSC Code 8125.

14. Critical Item Specifications (Type C2A) for the AMES OCR, 31 August 1978, NOSC Code 8125.

15. CG FIRST MARDIV 130023Z, May 1978.

16. Teletype Preparation Aid (MPA) Evaluation Aboard USS HORN (DLG 30), 14 February 1974, NELC TD 305.

17. SECNAVINST 10460.90 of 16 May 1978.

18. AMAP

APPENDIX A
OPTICAL CHARACTER READER (OCR) CHARACTERISTICS AND EQUIPMENTS

	Item Number	01	02	03	[illegible]	
1	Manufacturer	Cognitronics	Compuscan Inc	Compuscan Inc	Compuscan [illegible]	[illegible]
2	Model Number	System 170	OCRT 5100 LINESCAN	ALPHACOMM M 1	COMET SSA Se[illegible]	[illegible]
	Cost					
3	Basic unit	$33 600	INA	$40 000	$53 000 GSA [illegible]	[illegible]
4	Available options			user defined codes for data output	Secure St[illegible]; Secure Command [illegible]; COMET S[illegible]	[illegible]
	Throughput					
5	Characters per second	Approximately 60 up to 100	Up to 300	80	[illegible]	[illegible]
6	Pages per minute	3 up to 5	Approximately 4 (50 lines with 72 characters per line)	INA	INA	[illegible]
	Character Recognition					
7	Type styles recognized	OCR A and OCR B font	OCR A font and OCR B font	OCR A, OCR B, [illegible] all in upper and lower case	OCR A, OCR B [illegible] 1403 matrix [illegible]	[illegible]
8	Character set	Complete upper and lower case alphanumeric OCR A or OCR B plus punctuation and symbols	ASCII 64 characters	88 characters	88 characters	[illegible]
9	Recognition method	Topological and matrix matching	Advanced Matrix Match	INA	INA	INA
10	Character reject rate	1 in 5000 characters	INA	1 in 10 000 characters	INA	INA
11	Character substitution rate	1 in 50 000 characters	INA	1 in 2500 characters	[illegible]	[illegible]
12	Character pitch	10	10 or 12	10 or 12	10 or 12	INA
13	Characters per line	76	up to 80	INA	7[illegible]	INA
14	Character misalignment tolerance	INA	INA	INA	INA	INA
15	Character skew	INA	INA	INA	INA	INA
16	Character vertical separation	0.027	INA	INA	INA	INA
17	Character horizontal separation	0.014	INA	INA	INA	INA
18	Drop-out colors	Red and blue	OCR non read red and blue	INA	[illegible]	[illegible]
	Page Input					
19	Page size	8" X 10½"	up to 8½" X 14	8 X 10	[illegible] X 11	[illegible]
20	Paper weight	20 lb to card stock	12 lb to card stock	INA	INA	INA
21	Paper thickness	0.003" to 0.007"	INA	INA	INA	INA
22	Margins	¼" all sides	about 1/16"	INA	[illegible]	INA
23	Reflectivity	70% minimum	INA	INA	INA	INA
	Line Input					
24	Maximum line length	7.6"	8 3/8"	INA	INA	INA
25	Line pitch	up to 6	5 or 6, 3 if double spaced		6 or 3	INA
26	Line skew	0.03" per inch	one character height per line length		INA	INA
27	Line misalignment	± 0.027"	INA		INA	INA
28	Lines per page	up to 20	up to 50		24	INA
	Edit Features					
29	Character delete	Yes	INA	Yes	Yes	INA
30	Line delete	No	INA	Yes	Yes	INA
31	Programmable scanning	Yes (requires complete program change)	Yes	INA	Yes	INA
	Status Indicators			INA		
32	Page reject	Yes	Yes		Yes	INA
33	Jamming detection	Yes	INA		Yes	
34	Error	Yes	No		INA	
35	Power available	INA	INA		INA	
36	Power on	INA	Yes		Yes	
	Mechanical Input, Output and Transfer of Page			INA		
37	Automatic feeder and capacity	Yes, 50 sheets	Yes, 50 pages		Yes, 50 pages	Yes, 50 pages
38	Reject hopper available and stack capacity	Yes, 50 sheets	Yes, greater than 50		Yes	INA
39	Output stacker capacity	50 sheets	greater than 50		INA	INA
40	Page recovery during jam conditions	Yes	INA		INA	INA
41	**Transmission Interfaces Available**	RS-232-C	EIA RS-232C; MIL-STD-188; up to 3 asynchronous or synchronous; up to 3 parallel	MIL-STD-188-100	MIL STD 188 100	INA
42	**Transfer Rates Available**	600 or 1200 baud	2400 and 4800 bits/second	75 to 9600 baud asynchronous up to 64 kilobits/sec isochronous	110 to 9600 baud	INA
43	**Self Test Mode**	INA	INA	INA	INA	INA
44	**Military Specification Conformance**	MIL-STD-188C NAVSEM 5100	MIL-STD-188C NAVSEM 5100	MIL-STD-188-100	MIL STD 188 C; MIL STD 461A; NAVSEM 5100; MIL STD 188 100	INA
	Physical Dimensions				INA	
45	Depth (overall)	58½"	30"	28"		27"
46	Width (overall)	31"	26"	28"		39"
47	Height (overall)	45½"	24"	INA		

1 2

	05	06	07	08	09	10	
	LCS Corporation	Context Corporation	Context Corporation	Control Data Corporation	Cummins A[illegible] Corporation	Dest Data [illegible]	[illegible]
	Compu Text Scanner	Model 201	Model 210	92650	4225 11	OCR WORD	[illegible]
000 $3 400	$25 000 Video typing station $5 760 Electronic typing station $7 680	Approximately $15 000	Approximately $15 000	Approximately $25 000	$30 600	INA	INA
	up to 220 Three to eight	Up to 400 INA	400 5	684 Three to five	INA 5	200 400 [illegible] 6 18 [illegible] 75 characters [illegible] 10 [illegible]	up to 220 [illegible]
	OCR B International character set INA INA 1 in 20 000 characters INA INA INA INA INA INA light red and light blue	OCR B 85 standard 96 or 120 optional INA INA 1 in 10 000 characters 10 75 0.01" horizontal 0.05" vertical 0.1 INA INA INA	OCR B 86 INA 1 in 10 000 characters 1 in 15 000 characters 10 75 0.01" horizontal 0.05" vertical INA INA INA red or blue	OCR A OCR B 58 Matrix Matching 1 in 10 000 1 in 10 000 10 up to 80 1.6 vertical 2 [illegible] deviation 0.1 nominal 0.14 minimum red	OCR B INA INA INA INA INA INA INA INA INA INA INA	OCR A OCR B Modified Courier 12 88 INA 1 in 10 000 characters 1 in 100 000 characters 10 75 variable INA INA INA INA red [illegible]	OCR A OCR B OCR B [illegible] character set INA INA 1 in 2[illegible] INA INA INA INA INA INA light [illegible]
	5" X 5" up to 12" X 12" INA INA INA INA	8½" X 11" or 14" INA INA [illegible] sides, top and bottom INA	8½" X 11" up to 14" INA INA [illegible] sides, top and bottom INA	8" X 10" 8½" X 11" 20 to 24 lb INA 0.5" top and left; 0.25" bottom 0.3" right 70	INA INA INA INA INA	up to [illegible] 14" 18 [illegible] INA [illegible] needed [illegible] top and bottom INA	5" X 5" up to [illegible] INA INA [illegible] INA
	INA INA INA INA INA	7 up to 5 INA INA INA	7 up to 5 0.1" along line INA INA	7.7 up to 6 1.8 1.8 32	INA 3 or 4 INA INA INA	7.5 6 INA INA INA	paper width [illegible] 1 or 2 or 3 character pi[illegible] INA INA
	INA INA INA	Yes Yes INA	Yes Yes INA	Yes Yes Yes	INA INA INA	Yes Yes INA	Yes Yes INA
	INA	INA	INA	No No Yes No Yes	INA INA INA INA INA	INA INA INA INA INA	INA INA INA INA INA
	Yes, 50 pages INA INA INA	Yes INA INA INA	Yes 50 pages INA INA INA	Yes, up to 50 pages Yes, ½" stack ¾" stack INA	No INA INA INA	Yes, 200 pages INA INA INA	Yes, 50 pages INA INA INA
	INA	RS-232, parallel or serial data	ASCII 8 bit parallel ASCII 8 bit serial 2741 IBM 6 bits and parity	RS-232	INA	RS-232 current loop (20 or 60 ma)	RS 232 2741 current loop
	INA	up to 9600 baud	110 to 9600 baud (serial) 113.6 to 9600 baud (2741 IBM)	600–38, 400 baud synchronous 75 to 9600 baud asynchronous	INA	110 to 9600 baud asynchronous	75 to 9600 baud
	INA	INA	INA	Yes	INA	INA	INA
188-100	INA	INA	INA	INA	INA	INA	INA
	27" 39"	19½" 30"	19½" 30"	23" 41"	INA	29" 27"	27" 39"

	11	12	13	14	15	16	
	Hendrix	International Business Machines (IBM)	Optical Business Machines	Scan Data Corporation	Scan Optics Incorporated	Scan Optics Incorporated	Systematics
	Typereader	3886	Laser OCR ONE	2250 1 OCR System	515 System	System 540 Model III	SGC T51
	INA	INA	INA	$288 000 (475 recognition unit) Multifont capability	$50 400 up to $80 700 Document serializer microfilming module	$200 000 to $250 000	INA
	Up to 220	155	320 (8 X 11 page	400 up to 1600 optional	Up to 250	INA	INA
ne	Three to four	4 1	8 8 (8 X 11 page	INA	7	(50 min for 30 lines 460 characters each	INA
	OCR A OCR B	OCR A OCR B 3 16 Gothic	OCR A OCR B Handprint	OCR A or OCR B	OCR A OCR B 3 16 Gothic	OCR A OCR B 1403 407 1 Alphanumeric 3 16 Gothic	INA
	OCR B including International character set	56	56	Upper and lower case and numerics	Alphanumerics plus special characters	INA	INA
	INA	INA	Matrix Match	Feature analysis	Feature analysis	Feature analysis	INA
	INA	INA	INA	INA	INA	INA	INA
	1 in 20 000	INA	INA	INA	INA	INA	INA
	INA	INA	8 9 or 10	10 or 12	10	10	INA
	INA	78	80	INA	80	up to 85	INA
	INA	INA	0 75 character height 3 line inch 0 1 character height 6 line inch	INA	INA	INA	INA
	INA	INA	3 from vertical	INA	INA	INA	INA
	INA	INA	1 6 minimum	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA
c carbo	light red light blue	INA	INA	INA	INA	INA	INA
	5" X 5 up to 12" X 12"	3" X 3" to 9 X 12	2 9 X 3 25 up to 8 5 X 13 5	5" X 3 up to 11 X 14	2 X 2 up to 9 X 14	4 X 3 up to 9 X 14	INA
	INA	INA	15 to 36 lbs 90 to 100 lbs	15 to 32 lbs	16 to 100 lbs	INA	INA
	INA	INA	0 003 to 0 008	INA	INA	INA	INA
top	on sides 1 or top and bottom	0 542" top 0 3" right, 0 5 left, 0 25" bottom	0 17" top and bottom 0 25 left 0 15" right	INA	INA	INA	INA
	INA	INA	greater than 80 at red light wavelength	INA	INA	INA	INA
			8 1"				
	paper width minus 1	7 7 (8 wide paper)	3 or 6	INA	8"	8	INA
	1 or 2 or 3	3	1 6 maximum for 3 line inch	INA	up to 6	up to 6	INA
	character per line	INA	1 2 maximum for 6 line inch	INA	INA	INA	INA
			INA				
	INA	INA	up to 78 max for 8 X 11"	INA	INA	INA	INA
	INA	29	30 typical for 8 X 11"	INA	INA	INA	INA
	Yes	Yes	Yes	INA	INA	INA	INA
	Yes	Yes	Yes	INA	INA	INA	INA
	INA	Yes	Yes	Yes	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	Yes
	INA	Yes	INA	INA	INA	INA	INA
	INA	No	INA	INA	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	Yes
	Yes, 50 pages	Yes, 1" stack, 4" stack optional	Yes, 4" stack	Yes, 6" stack	Yes	Yes	Yes
	INA	Yes, 1" stack, 4" stack optional	Yes, 4" stack	Yes, 6" stack	INA	INA	INA
	INA	1" stack, 4" stack optional	2" stack	6" stack	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	Yes
	RS-232 2741 current loop	INA	INA	INA	INA	INA	MIL STD 1
ous	75 to 9600 baud including 134.5	INA	INA	1200 to 9600 baud	INA	up to 9600 synchronous	up to 960
	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	MIL STD 18 MIL STD 18
	27"	70"	32½"	INA	45"	34"	INA

14	15	16	17	18	19
Scan Data Corporation	Scan Optics Incorporated	Scan Optics, Incorporated	Systematics General Corporation	Vydec Incorporated	Recognition Equipment Inc (REI) Dallas Texas
2250 1 OCR System	515 System	System 540 Model III	SGC T5102	Model 0760 01	Input 80 Model C1
S288 000 (475 recognition unit)	$50,400 up to $80,700	$200,000 to $250,000	INA	INA	$200 000 includes magnetic tape mini computer CRT console and printer
Multifont capability	Document serializer, microfilming module				
400 up to 1600 optional	Up to 250	INA	INA	INA	INA
INA	7"	(50 min for 30 lines, 460 characters each)	INA	INA	55 (8½" X 11")
OCR A or OCR B	OCR A OCR B 3 16" Gothic	OCR A OCR B 1403 407 1 Alphanumeric, 3 16" Gothic	INA	OCR B	INA
Upper and lower case and numerics	Alphanumerics plus special characters	INA	INA	INA	64
Feature analysis	Feature analysis	Feature analysis	INA	INA	Matrix Matching
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
10 or 12	10	10	INA	10	7 to 12
INA	80	up to 85	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
5" X 3" up to 11" X 14	2" X 2½" up to 9" X 14	4" X 3" up to 9" X 14"	INA	8½" X 11"	2 9" X 2 75" up to 12" X 14
15 to 32 lbs	16 to 100 lbs	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	1" top and bottom, ½" sides	INA
INA	INA	INA	INA	INA	INA
INA	8"	8"	INA	INA	INA
INA	up to 6	up to 6	INA	1½, 2 or 3	up to 4
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
Yes	INA	INA	INA	INA	Yes
INA	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
Yes, 6" stack	Yes	Yes	Yes, ¼" stack	Yes, 50 page stack	Yes
Yes, 6" stack	INA	INA	INA	INA	Yes
6" stack	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
INA	INA	INA	MIL STD 188-100	INA	INA
1200 to 9600 baud	INA	up to 9600 synchronous	up to 9600 baud	INA	up to 9600 baud
INA	INA	INA	INA	INA	INA
			MIL STD 188 C NAVSEM 5100		
INA	INA	INA	MIL STD 188 100	INA	INA
INA	45"	34"	INA	27"	INA
INA	72"	91"	INA	39"	INA

	[illegible] separat[illegible]	[illegible]	[illegible]	[illegible]		
18	Drop [illegible]	Red and blue	OCR [illegible] read red and blue	INA	[illegible]	
	Page input					
19	Page size	8 x 10	up to 8" x 14	8 x 10	[illegible]	[illegible]
20	Paper weight	20 lb to card stock	12 lb to card stock	INA	N/A	[illegible]
21	Paper thickness	0.003 to 0.007"	INA	INA	N/A	[illegible]
22	Margins	[illegible] all sides	about 1 16	INA	[illegible]	[illegible]
23	Reflectivity	70% minimum	INA	INA	N/A	[illegible]
	Line input					
24	Maximum line length	7.6"	8 3 8	INA	N/A	[illegible]
25	Line pitch	up to 6	5 or 6, 3 if double spaced		[illegible]	[illegible]
26	Line skew	0.03 per inch	one character height per line length		INA	[illegible]
27	Line misalignment	± 0.027"	INA		N/A	[illegible]
28	Lines per page	up to 20	up to 50		24	N/A
	Edit Features					
29	Character delete	Yes	INA	Yes	[illegible]	[illegible]
30	Line delete	No	INA	Yes	[illegible]	[illegible]
31	Programmable scanning	Yes (requires complete program change)	Yes	INA	[illegible]	[illegible]
	Status Indicators			INA		
32	Page reject	Yes	Yes		[illegible]	[illegible]
33	Jamming detection	Yes	INA		[illegible]	
34	Error	Yes	No		N/A	
35	Power available	INA	INA		N/A	
36	Power on	INA	Yes		Yes	
	Mechanical Input, Output and Transfer of Page			INA		
37	Automatic feeder and capacity	Yes, 50 sheets	Yes, 50 pages		Yes, 50 pages	[illegible]
38	Reject hopper available and stack capacity	Yes, 50 sheets	Yes, greater than 50		Yes	N/A
39	Output stacker capacity	50 sheets	greater than 50		INA	N/A
40	Page recovery during jam conditions	Yes	INA		INA	N/A
41	**Transmission Interfaces Available**	RS-232-C	EIA RS-232C, MIL STD 188, up to 3 asynchronous or synchronous, up to 3 parallel	MIL STD 188 100	MIL STD 188 100	N/A
42	**Transfer Rates Available**	600 or 1200 baud	2400 and 4800 bits second	75 to 9600 baud asynchronous, up to 64 kilobits sec isochronous	110 to 9600 baud	INA
43	**Self Test Mode**	INA	INA	INA	INA	INA
44	**Military Specification Conformance**	MIL STD 188C NAVSEM 5100	MIL STD 188C NAVSEM 5100	MIL STD 188 100	MIL STD 188 C MIL STD 461A NAVSEM 5100 MIL STD 188 100	INA
	Physical Dimensions				INA	
45	Depth (overall)	56½"	30"	28"		27
46	Width (overall)	31"	26"	28"		39
47	Height (overall)	45½"	24"	INA		40
48	Weight	465 lbs. (includes other than OCR)	100 lbs.	INA		300 lbs.
	Power Required					
49	Voltage (AC)	105 to 125 Volts AC	120 VAC	115 VAC + 23 VAC or 238 VAC + 48VAC	115 VAC	115 V
50	Current	9 Amperes	10 Amperes	7.5 Amps @ 115 VAC Starting 5.0 Amps @ 230 VAC Starting	7.5 to 10 Amperes	10 Amperes
51	Frequency	60 Hertz	47 to 63 Hertz	50 + 2.5 Hertz or 60 + 3 Hertz	60 Hertz	60 Hertz
52	Phases	INA	INA	Single	Single	INA
53	Watts	1035	INA	460	INA	INA
	Environmental					
54	Operating					
55	ambient temperature	40° to 90°F	5° to 40°C	10° to 26° C	10° to 32° C	10° to 40° C
56	humidity (non-condensing)	10 to 90%	5 to 95%	95% @ 25° C	20 to 95%	INA
57	Storage and shipping					
58	ambient temperature	INA	INA	- 20° to + 71°C	- 20° to + 71° C	INA
59	humidity (non-condensing)	INA	INA	INA	INA	INA
60	altitude	INA	INA	10,000 feet	10,000 feet	INA

INA = Information Not Available N/A = Not Applicable

	[illegible]	INA	[illegible]	red	INA	[illegible]	[illegible]
	[illegible]	8 x 11 [illegible] 14	8 x 11 [illegible] 14	8 x 10 8 x 11	INA	[illegible]	[illegible]
	INA	INA	INA	20 [illegible] 24 [illegible]	INA	[illegible]	NA
	INA	INA	INA	INA	INA	NA	NA
	INA	[illegible]	[illegible]	0.5 [illegible] 0.25 [illegible] 0.3 [illegible]	INA	[illegible]	[illegible]
	INA	INA	INA	70	INA	INA	NA
	INA	2		[illegible]	INA	[illegible]	[illegible]
	INA	up to 5	up to 5	[illegible]	3 to 4	6	[illegible]
	INA	INA	[illegible]	1 8	INA	INA	[illegible]
	INA	INA	INA	1 8	INA	INA	INA
	INA	INA	INA	32	INA	INA	NA
	INA	Yes	Yes	Yes	INA	Yes	Yes
	INA	Yes	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	Yes	INA	NA	NA
	INA	INA	INA	No	INA	NA	NA
				No	INA	INA	NA
				Yes	INA	NA	NA
				No	INA	INA	NA
				Yes	INA	INA	NA
	Yes 50 pages	Yes	Yes 50 pages	Yes up to 50 pages	No	Yes 200 [illegible]	[illegible]
	INA	INA	INA	Yes, [illegible] stack	INA	INA	INA
	INA	INA	INA	[illegible] stack	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA
	INA	RS 232, parallel or serial data	ASCII 8 bit parallel ASCII 8 bit serial 2741 IBM 6 bits and parity	RS 232	INA	RS 232 [illegible]	RS 232 [illegible] 2741
	INA	up to 9600 baud	110 to 9600 baud (serial) 113.6 to 9600 baud (2741 IBM)	600-38 400 baud synchronous 5 to 9600 baud asynchronous	INA	110 to 9600 baud asynchronous	75 to 96[illegible]
	INA	INA	INA	Yes	INA	INA	INA
STD 188 100	INA	INA	INA	INA	INA	INA	INA
	27"	19½"	19½"	23"	INA	29	27
	39"	30"	30"	41"		27	39
	40"	37½"	37½"	39"		40	40
	300 lbs.	160 lbs.	160 lbs.	400 lbs.		270 lbs.	300 lbs.
	115 V	115 V	115 V	100 to 120 | 100, 200, 220, 230, 240, 250	INA	115 VAC | 220 VAC	115 VAC
	10 Amperes	4 Amperes	4 Amperes	10 Ameres | 5 to 10 Amperes		15 Amperes | 7.5 Amperes	10 Amp[illegible]
	60 Hertz	50 or 60 Hertz	60 Hertz	60 Hertz | 50 Hertz		60 Hertz | 50 Hertz	60 Hertz
	INA	INA	INA	Single | Single		INA | INA	INA
	INA	INA	INA	INA | INA		INA	INA
	10° to 40°C	10° to 35°C	10° to 35°C	50° to 95°F	INA	0° to 40°C	10° to 40
	INA	20 to 80%	20 to 80%	20 to 80%		10 to 90%	30 to 80
	INA	INA	INA	INA		INA	INA
	INA	INA	INA	INA		INA	INA
	INA	INA	INA	INA		INA	INA

6

[illegible]	ight red light blue	INA	INA	INA	INA	INA
[illegible] ded on sides, 1 on top	5 X 5 up to 12 X 12 INA INA on sides, 1 on top and bottom INA	3 X 3 to 9 X 12 INA INA 0 542 top, 0 3 right, 0 5 left 0 25 bottom INA	2 9 X 3 25 up to 8 5 X 13 5 15 to 36 lbs 90 to 100 lbs 0 003 to 0 008 0 17 top and bottom, 0 25 left 0 15 right greater than 80 at red light wavelength	5 X 3 up to 11 X 14 15 to 32 lbs INA INA INA	2 X 2 up to 9 X 14 16 to 100 lbs INA INA INA	4 X 3 up to 9 X 14 INA INA INA INA
	paper width minus 1 1 or 2 or 3 character per line INA INA	7 7 8 wide paper 3 INA INA 29	8 1 3 or 6 1 6 maximum for 3 line inch 1 2 maximum for 6 line inch INA up to 78 max for 8 X 11 30 typical for 8 X 11	INA INA INA INA INA	6 up to 6 INA INA INA	8 up to 6 INA INA INA
	Yes Yes INA	Yes Yes Yes	Yes Yes Yes	INA INA Yes	INA INA INA	INA INA INA
	INA INA INA INA INA	Yes Yes Yes No Yes	INA INA INA INA INA	INA INA INA INA INA	INA INA INA INA INA	INA INA INA INA INA
	Yes, 50 pages INA INA INA	Yes, 1 stack, 4 stack optional Yes, 1 stack, 4 stack optional 1" stack, 4" stack optional Yes	Yes 4 stack Yes 4 stack 2 stack INA	Yes 6 stack Yes 6 stack 6" stack INA	Yes INA INA INA	Yes INA INA INA
[illegible]	RS 232 2741 current loop	INA	INA	INA	INA	INA
d asynchronous	75 to 9600 baud including 134 5	INA	INA	1200 to 9600 baud	INA	up to 9600 synchronous
	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA
	27" 39" 40" 300 lbs.	70" 30" 60" 1500 lbs.	32" 48" 66" 1100 lbs.	INA INA INA INA	45" 72" 46" INA	34" 91" 74" INA
220 VAC 7.5 Amperes 50 Hertz INA	115 VAC 220 VAC 10 Amperes 5 Amperes 60 Hertz 50 Hertz INA INA INA	208 or 230 INA INA 3 Phases INA	117 VAC 14 Amperes 60 Hertz Single INA	INA INA INA INA INA	250 V 20 Amperes 50 or 60 Hertz Single 3.08 Kilowatts	208 VAC 25 Amps phase 50 or 60 Hertz 3 phases INA
	10 to 40 C 30 to 80% INA INA INA	INA INA INA	60 to 95 F 40 to 70% INA INA 0 to 7500 feet	INA INA INA INA INA	10 to 35 C 20 to 80% INA INA INA	65 to 78 F 40 to 60% INA INA INA

INA	INA	INA	INA	INA	INA
[illegible] x 14	2 x 2 [illegible]	[illegible] 9 x 14	INA	8 x 11	2.9 x 2.75 up to 12 x 14
[illegible] 32 lb	16 [illegible] 100 lb	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	1 top and bottom [illegible] sides	INA
INA	INA	INA	INA	INA	INA
INA	[illegible]	[illegible]	NA	INA	INA
INA	[illegible]	[illegible]	INA	1, 2 or 3	up to 4
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
[illegible]	INA	INA	INA	INA	Yes
INA	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
Yes [illegible] stack	Yes	Yes	Yes [illegible] stack	Yes 50 page stack	Yes
Yes [illegible] stack	INA	INA	INA	INA	Yes
[illegible] stack	INA	INA	INA	INA	INA
INA	INA	INA	Yes	INA	INA
INA	INA	INA	MIL STD 188 100	INA	INA
1200 to 9600 baud	INA	up to 9600 synchronous	up to 9600 baud	INA	up to 9600 baud
INA	INA	INA	INA	INA	INA
INA	INA	INA	MIL STD 188 C NAVSEM 5100 MIL STD 188 100	INA	INA
INA	45"	34"	INA	27"	INA
INA	72"	91"	INA	39"	INA
INA	46"	74"	INA	40"	INA
INA	INA	INA	INA	300 lbs	INA
INA	250 V	208 VAC	105 to 125 V	115 VAC	INA
INA	20 Amperes	25 Amps phase	12 Amperes	8 Amperes	INA
INA	50 or 60 Hertz	50 or 60 Hertz	60 Hertz	60 Hertz	INA
INA	Single	3 phases	INA	INA	INA
INA	3.08 Kilowatts	INA	INA	INA	INA
INA	10 to 35 C	65 to 78 F	40 to 90 F	16 to 38 C	INA
INA	20 to 80%	40 to 60%	10 to 95%	30 to 80%	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA

APPENDIX B

KEYBOARD DISPLAY TERMINAL (KDT) CHARACTERISTICS
AND EQUIPMENTS

1	Item Number	01	02	03	04	05	06	07	08
2	Manufacturer	Applied Digital Data Systems, Inc	American Microsystems, Inc	Ann Arbor Terminals, Inc	Beehive International	Beehive International	Burroughs	Computer Communications, Inc	Conrac Data Products
3	Model Number	Regent 200	MDC 110	400E	8500	6000	TD830	CC 40 Communications Station	400 75
4	Cost Range	INA	$5500.00	$1395.00	$2000.00	INA	INA	INA	INA
5	Available options	Editing Package	Dual floppy disk drive, extra 32 RAM available		Expandable memory			Color CRT	TTY Keyboard
	Keyboard								
6	Typewriter keypad	No	Yes	No	Yes	Yes	Yes	Yes	Yes
7	Numeric keypad	Yes, 14 keys	No	Yes	Yes, 11 keys	Yes, 10 keys	Yes, 10 Key	No	No
8	Cursor control keypad	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
9	General purpose function keys, user defined	Yes, 8 keys	Yes	INA	Yes	Yes	Yes	Yes	Yes
10	Edit keys	Yes	Yes	INA	Yes	INA	Yes	INA	Yes
11	TTY keyboard	Standard teletypewriter like	No	Yes	No	No	No	No	Optional
12	Key modes	2	INA	Yes	INA	INA	INA	INA	INA
13	Detachable keyboard	No	No	Yes	Yes	INA	Yes	Yes	No
14	Repeat on keys	INA	INA	INA	Yes	Yes	Yes Character and Function Keys	INA	INA
15	N key rollover	INA	INA	INA	INA	Yes	INA	Yes	INA
16	Keylock switch	No	INA	INA	INA	Yes	INA	INA	INA
17	Lighted keys	INA	INA	INA	Yes	INA	INA	INA	INA
	Display Capability								
18	Non glare screen	INA	INA	Yes	INA	INA	INA	INA	INA
19	Character set	128 displayable ASCII 11 special graphic symbols	256 unique input characters ASCII encoded	64 ASCII	128	249	Up to 128	Upper lower and non standard	ASCII 64 subset Optional 128
20	Tilt screen	No	No	No	No	No	No	No	No
21	Swivel screen	No	No	No	No	No	No	No	No
22	Programmable brightness	INA	INA	INA	Two	Yes	Yes	INA	INA
23	No. of levels					Two	Two		
24	Number of lines	24	25	24	25	25	25	24	25
25	Characters per line	80	80	80	80	80	80	80	80
26	Reverse video (programmable)	Yes	INA	Yes	Yes	Yes	Yes	INA	INA
27	Blinking (programmable)	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
28	Screen size	12" diagonal	12" diagonal	15" diagonal	12" diagonal	12" diagonal or 15" diagonal	9" X 6"	11"	12" diagonal
29	Non-display field for security	INA	INA	INA	INA	INA	Yes	INA	Programmable
30	Color display capability	No	None	No	None	None	None	Optional	No
31	Cursor	Yes							
32	control (key, program or both)	both	Key	Key	Key and program	Key and program	Program	Key and program	Program and key
33	type (blinking, underline reverse video, etc.)	INA	INA	Blinking	INA	Blinking, underscore	Blinking or reverse video	INA	Blinking
34	addressable	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
35	Dot Matrix for characters (8 X 10, 10 X 16, etc.)	Yes, 8 X 8	INA	INA	7 X 8	5 X 7	5 X 7	5 X 7	5 X 7
36	Status displays (lights or line on CRT)	Yes, 25th line on CRT	INA	INA	Yes	INA	25th line on CRT	INA	26th line on CRT
37	Flicker free								
38	refresh screen data rate	60 frames per second	INA	INA	50/60 Hertz	60 Hertz	INA	INA	50 or 60 Hertz
39	phosphor type (e.g., P-4)	INA	INA	INA	INA	INA	INA	INA	P 4
40	Memory size for display	24 lines by 80 characters	INA	80 characters X 25 lines	Two pages 50 lines X 80 characters	INA	2000 to 4000 characters	INA	2000 characters (1 page), additional 2000 characters optional
	Compose and Edit Features								
41	Erase to end of line	Yes	INA	INA	INA	INA	Yes	INA	Yes
42	Erase to end of page	Yes	INA	INA	INA	INA	Yes	INA	Yes
43	Character delete	Optional	Yes	INA	Yes	INA	Yes	INA	Yes
44	Line delete	Optional	INA	INA	Yes	INA	Yes	INA	Yes
45	Clear screen	INA	INA	INA	INA	INA	Programmable	INA	Yes
46	Character overwrite	Yes	INA	INA	INA	INA	INA	INA	INA
47	Character insert	Optional	Yes	INA	Yes	INA	Yes	INA	Yes
48	Line insert	Optional	INA	INA	Yes	INA	Yes	INA	Yes
49	Backspace	Yes	INA	INA	INA	No	INA	INA	INA
50	Forward tab	Yes	INA	INA	Yes	Yes	Yes	INA	Yes
51	Backward tab	Yes	INA	INA	Yes	Yes	Yes	INA	Yes
52	Adjust space and line automatically when characters, words, or sentences are added or deleted (word wrap)	INA	INA	INA	INA	INA	Yes	INA	INA
53	Automatically change paging when additions or deletions are made	INA	INA	INA	INA	INA	Yes	INA	INA
54	Clear unprotected data	INA	INA	INA	INA	INA	Programmable	INA	Yes
55	Scroll up or down	INA	INA	INA	Up or down	INA	Up or down	INA	Programmable
56	Audible alarm for end of line	INA	INA	INA	Yes	Yes	Yes	INA	INA
57	Audible alarm for end of page	INA	INA	INA	INA	INA	Yes	INA	INA
58	Automatic paging	No	INA	INA	INA	INA	Yes	INA	INA
59	Protected fields (programmable)	Yes	INA	INA	Yes	INA	Yes	INA	Yes
60	Cursor control from keyboard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	INA
61	Line number display	INA	INA	INA	INA	INA	INA	INA	INA
62	Column number display	INA	INA	INA	INA	INA	INA	INA	INA
63	Word search for delete or replace	INA	INA	INA	INA	INA	Yes	INA	INA
64	Next page	No	INA	INA	Yes	INA	Programmable	INA	INA
65	Previous page	No	INA	INA	INA	INA	Programmable	INA	INA
66	First page	No	INA	INA	INA	INA	Programmable	INA	INA
	Communication Interface and Control								
67	Type interface	EIA RS-232-C/CCITT V.24 20/60 ma current loop	INA	RS-232 (Data) RS-170 (Video)	RS-232C	RS-232C Current loop Up to 19.2K Baud	Asynchronous; 2 wire direct Synchronous, Burroughs Direct Connect (BDC)	RS-232 CC-72 Long line	RS-232 Current loop Asynchronous or synchronous
68	Transmission rates	75 to 19.2K Bps (RS-232-C) 75 to 9600 Bps (current loop) All rates are switch selectable 12 rates available		110-9600 Baud rates	Selectable up to 19,200 bps	Up to 19.2K Baud	Up to 9600 Bps (wire) Up to 38,400 Bps (BDC)	150, 300, 1200 and 1800 Baud asynchronous Up to 9600 Baud asynchronous 50Kb on long line	110 through 9600 Baud switchable
69	Transmission modes								
70	character at a time	Yes		INA	Yes	INA	Programmable	INA	Programmable
71	line at a time	Yes		INA	Yes	INA	Programmable	INA	Programmable
72	full screen at a time	Yes		INA	Yes	INA	Yes	INA	Programmable
73	partial screen at a time	Yes		INA	INA	INA	Yes	INA	Programmable
74	multiple pages at a time	No		INA	INA	INA	INA	INA	Programmable
75	polling	INA		INA	INA	INA	Yes	Yes	Programmable
76	Military Specifications	INA	INA	INA	INA	INA	INA	INA	INA

8	9	10	11	12	13	14	15	16	17	18
...onic Data Products	Control Data Corporation	Control Data	CPT Corporation	ITT Courier Terminal Systems, Inc	Data General Corporation	Datagraphix, Inc	Digi Log Systems, Inc	Digital Equipment Corp	Digital Equipment Corp	...Data Sys...
...0-25	92466	751 10	Model 1 8000 Series (has dual diskette drive)	275	Dasher Display 6053	Model 1328	Microterm II	VT 55	VT 100 Video Terminal	4050
INA	INA	INA	INA	INA	INA	INA	$6660 up to $8000	$2500 to $2800	INA	INA
...Y Keyboard					Printer interfaces	Polling capabilities	Dual Disk, Internal Printer			Model 4100 ...
...s	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
...	Yes	Yes	Optional	Yes	Yes	Yes	Yes	Yes	Yes	Yes
...	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
...	Yes	No	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
...	Yes	Yes	INA	Yes	Yes	Yes	Yes	INA	INA	Yes
...ptional	No	Yes	INA	No	No	No	No	No	No	No
...A	INA	Two	INA	INA	INA	INA	Yes, four	INA	INA	INA
...	Yes	Yes	INA	INA	Yes	Yes	No	No	Yes	No
...A	INA	Optional	INA	INA	INA	Yes	Yes	Yes	INA	INA
...A	Yes	Yes	INA	INA	INA	INA	Yes	Three key rollover	INA	INA
...A	INA	INA	INA	Optional	INA	INA	INA	INA	INA	Optional
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
...A	Yes	Yes	INA	Yes	Yes	INA	Yes	Yes	INA	INA
...SCII 64 subset ...ptional 128	96 ASCII Characters & 32 Control Symbols	96 ASCII Characters & 33 Control Codes	INA	INA	96 Characters	128 Characters	INA	96 Characters ASCII	INA	224 displayable
...s	No	No	INA	No	Yes	No	No	No	No	No
...	No	No	INA	No	Yes	No	No	No	No	No
...A	Yes	Yes	INA	Yes	Yes	INA	Yes	INA	Yes	INA
	Two	Two	INA	Two	Two	INA	Two	INA	Two	INA
...	24	24	54	24	24	30	24	24	24	25
...	80	80	80	80	80	132	80	80	80 or 132	80
...A	INA	INA	INA	INA	No	No	Yes	INA	Yes	Yes
...s	Yes	Yes	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes
..." diagonal	12" diagonal	12" diagonal	8" X 10 1/2"	INA	12" diagonal	11" wide X 8" high	12" diagonal	12" diagonal	INA	14" diagonal
...ogrammable	INA	INA	INA	Yes	INA	INA	INA	INA	INA	INA
...o	None	None	INA	INA	No	INA	Green	No	None	Green
			INA	Key	Key and program	Key and program	Key	Key and program	Key	
...ogram and key	Key Program	Key & Program	INA	Underline or blinking underline	INA	Blinking	INA	Blinking underline	INA	Key and program
...inking	INA	Blinking, Underline	INA	INA	Yes					Blinking underline
...s	Yes	Yes	INA	INA	5 X 8	Yes	INA	Yes	INA	Yes
...X 7	7 X 9	7 X 9	INA	Lights	INA	INA	7 X 11	7 X 7	7 X 9	5 X 7
...th line on CRT	INA	INA	INA	Yes	INA	INA	INA	INA	Entire screen	INA
						INA	INA	INA	INA	INA
... or 60 Hertz	50 or 60 Hertz	INA	INA	INA	INA	INA	INA	INA	INA	60 Hertz
...4	P-4	INA	INA	INA	P-4	INA	P-31	P-4	INA	P-31 (P-4 optional)
...00 characters (1 page) ...dditional 2000 characters optional	INA	INA	100 pages per diskette	INA	INA	7920 characters (2 pages)	INA	INA	INA	2048 Characters
...s	Yes	INA	INA	INA	Yes	INA	Yes	INA	INA	INA
...s	Yes	INA	INA	INA	INA	INA	Yes	INA	INA	INA
...s	Optional	Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes
...s	Optional	Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes
...es	INA	INA	INA	INA	Yes	INA	Yes	INA	INA	Yes
...A	Yes	INA	INA	INA	INA	Yes	INA	INA	INA	INA
...es	Optional	Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes
...es	Optional	Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes
...A	INA	INA	INA	INA	INA	Yes	INA	INA	INA	INA
...es	Optional	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes
...es	Optional	INA	INA	Yes	INA	INA	No	INA	INA	Yes
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
...A	INA	INA	Optional	INA	INA	INA	INA	INA	INA	INA
...es	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
...rogrammable	INA	Optional	Scroll up	INA	INA	Yes	Yes	Yes	Yes	Scroll up
...A	INA	Yes	INA	INA	INA	INA	INA	INA	INA	Yes
...A	INA	Yes	INA	INA	INA	INA	INA	INA	INA	INA
...A	INA	INA	Yes	INA	INA	INA	INA	INA	INA	INA
...es	Optional	Yes	INA	Yes	INA	Yes	INA	INA	INA	INA
...A	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	On Model 4380E
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	Yes
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	Yes
...A	INA	INA	INA	INA	INA	INA	INA	INA	INA	No
...S-232 current loop asynchronous or synchronous	RS 232 Loop current (optional)	RS-232-C CCITT V.24	INA	INA	20 ma current loop RS-232-C	RS-232-C 20 milliamp current loop	RS-232-C CCITT	RS-232 20 ma current loop	EIA 20 ma optional	RS-232 C
...10 through 9600 Baud switchable	110 to 9600 Baud	110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 Baud	INA	Up to 9600 Bps	10 rates up to 19.2 Kbps	110, 150, 300, 600, 1200, 2400, 4800, 9600 Bps	9600 Baud asynchronous, over 20,000 Baud synchronous	75, 110, 300, 600, 1200, 2400, 4800, 9600 Baud	Up to 19,200 Baud	Up to 9600 Baud sync... or asynchronous
...rogrammable	Yes	INA	INA	INA	INA	Yes	INA	INA	INA	INA
...rogrammable	INA	INA	INA	INA	INA	Yes	INA	INA	INA	INA
...rogrammable	Yes	INA	INA	INA	INA	Yes	INA	INA	INA	INA
...rogrammable	INA	Optional	INA	INA	INA	INA	INA	INA	INA	INA
...rogrammable	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
...rogrammable	INA	Optional	INA	INA	INA	Optional	Yes	INA	INA	Yes
...NA	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA

10	11	12	13	14	15	16	17	18	19
Control Data	CPT Corporation	ITT Courier Terminal Systems, Inc	Data General Corporation	Datagraphix, Inc	Digi Log Systems, Inc	Digital Equipment Corp	Digital Equipment Corp	Delta Data Systems Corp	FECO
751 10	Model 1, 8000 Series (has dual diskette drive)	275	Dasher Display 6063	Model 1328	Microterm II	VT 55	VT 100 Video Terminal	4050	D400
INA	INA	INA	INA Printer interfaces	INA Polling capabilities	$6550 up to $8000 Dual Disk, Internal Printer	$2580 to $2800	INA	INA Model 4100 & Model 4300E	INA
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Optional	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	INA	Yes	Yes	Yes	Yes	INA	INA	Yes	Yes
Yes	INA	No	No	No	No	No	No	No	Yes
Two	INA	INA	INA	INA	Yes, four	INA	INA	INA	INA
Yes	INA	INA	Yes	Yes	No	No	Yes	No	Yes
Optional	INA	INA	INA	Yes	Yes	Yes	INA	INA	INA
Yes	INA	INA	INA	INA	Yes	Three key rollover	INA	INA	Two key rollover
INA	INA	Optional	INA	INA	INA	INA	INA	Optional	INA
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Yes	INA	Yes	Yes	INA	Yes	Yes	INA	INA	INA
96 ASCII Characters & 33 Control Codes	INA	INA	96 Characters	128 Characters	INA	96 Characters, ASCII	INA	224 displayable	128 ASCII [illegible]
No	INA	No	Yes	No	No	No	No	No	No
No	INA	No	Yes	No	No	No	No	No	No
Yes	INA	Yes	Yes	INA	Yes	INA	Yes	INA	Yes
Two	INA	Two	Two	INA	Two	INA	Two	INA	Two
24	54	24	24	30	24	24	24	25	24
80	80	80	80	132	80	80	80 or 132	80	80
INA	INA	INA	No	No	Yes	INA	Yes	Yes	Yes
Yes	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes
12" diagonal	8" X 10-1/2"	INA	12" diagonal	11" wide X 8" high	12" diagonal	12" diagonal	INA	14" diagonal	12" diagonal
INA	INA	Yes	INA	INA	INA	INA	INA	INA	Yes
None	INA	INA	No	INA	Green	No	None	Green	None
	INA	Key	Key and program	Key and program	Key	Key and program	Key		
Key & Program	INA	Underline or blinking underline	INA	Blinking	INA	Blinking underline	INA	Key and program	Key and program
Blinking, Underline	INA	INA	Yes					Blinking underline	Reverse image block, blinking or non blinking
Yes	INA	INA	5 X 8	Yes	INA	Yes	INA	Yes	Yes
7 X 9	INA	Lights	INA	INA	7 X 11	7 X 7	7 X 9	5 X 7	5 X 9
INA	INA	Yes	INA	INA	INA	INA	Entire screen	INA	Yes
				INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA	INA	INA	60 Hertz	50 or 60 Hertz
INA	INA	INA	P-4	INA	P-31	P-4	INA	P-31 (P-4 optional)	P-4
INA	100 pages per diskette	INA	INA	[illegible] pages	INA	INA	INA	2048 Characters	INA
INA	INA	INA	Yes	INA	Yes	INA	INA	INA	Yes
INA	INA	INA	INA	INA	Yes	INA	INA	INA	Yes
Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes	Yes
Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes	Yes
INA	INA	INA	Yes	INA	Yes	INA	INA	Yes	Yes
INA	INA	INA	INA	Yes	INA	INA	INA	INA	INA
Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes	Yes
Yes	INA	INA	INA	Yes	Yes	INA	INA	Yes	Yes
INA	INA	INA	INA	Yes	INA	INA	INA	INA	Yes
INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
INA	INA	Yes	INA	INA	No	INA	INA	Yes	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	Optional	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA	INA	INA	INA	Yes
Optional	Scroll up	INA	INA	Yes	Yes	Yes	Yes	Scroll up	Yes
Yes	INA	INA	INA	INA	INA	INA	INA	Yes	INA
Yes	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	Yes	INA	INA	INA	INA	INA	INA	INA	INA
Yes	INA	Yes	INA	Yes	INA	INA	INA	INA	Yes
Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA	INA	INA	On Model 4300E	INA
INA	INA	INA	INA	INA	INA	INA	INA	Yes	INA
INA	INA	INA	INA	INA	INA	INA	INA	Yes	INA
INA	INA	INA	INA	INA	INA	INA	INA	No	INA
RS-232-C CCITT V.24	INA	INA	20 ma current loop RS-232-C	RS-232-C 20 milliamp current loop	RS-232-C CCITT	RS-232 20 ma current loop	EIA 20 ma optional	RS-232-C	RS-232-C 20 ma current loop
110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 Baud	INA	Up to 9600 Bps	18 rates up to 19.2 Kbps	110, 150, 300, 600, 1200, 2400, 4800, 9600 Bps	9600 Baud asynchronous, over 20,000 Baud synchronous	75, 110, 300, 600, 1200, 2400, 4800, 9600 Baud	Up to 19,200 Baud	Up to 9600 Baud synchronous or asynchronous	50 through 19,200 Bps in 16 steps
INA	INA	INA	INA	Yes	INA	INA	INA	INA	INA
INA	INA	INA	INA	Yes	INA	INA	INA	INA	INA
INA	INA	INA	INA	Yes	INA	INA	INA	INA	Yes
Optional	INA	INA	INA	INA	INA	INA	INA	INA	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Optional	INA	INA	INA	Optional	Yes	INA	INA	Yes	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA

29	Non display field for security	INA	N/A	N/A	N/A	N/A		[illegible]	
30	Color display capability	No	None	No	None	None	None	Optional	[illegible]
31	Cursor	Yes							
32	control (key, program or both)	both	Key	Key	Key and program	Key and program	Program	Key and program	Program
33	type (blinking, underline, reverse video, etc.)	INA	INA	Blinking	N/A	Blinking, underscore	Blinking or reverse video	INA	Blinking
34	addressable	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
35	Dot Matrix for characters (8 X 10, 10 X 16, etc.)	Yes, 8 X 8	INA	INA	7 X 8	5 X 7	5 X 7	5 X 7	5 X 7
36	Status displays (lights or line on CRT)	Yes, 25th line on CRT	INA	INA	Yes	INA	25th line on CRT	INA	26th line
37	Flicker free								
38	refresh screen data rate	60 frames per second	INA	INA	50/60 Hertz	60 Hertz	INA	INA	50 or 60 H...
39	phosphor type (e.g., P-4)	INA	INA	INA	INA	INA	INA	INA	P 4
40	Memory size for display	24 lines by 80 characters	INA	80 characters X 25 lines	Two pages - 50 lines X 80 characters	INA	2000 to 4000 characters	INA	2000 chara... additional ...
	Compose and Edit Features								
41	Erase to end of line	Yes	INA	INA	INA	INA	Yes	INA	Yes
42	Erase to end of page	Yes	INA	INA	INA	INA	Yes	INA	Yes
43	Character delete	Optional	Yes	INA	Yes	INA	Yes	INA	Yes
44	Line delete	Optional	INA	INA	Yes	INA	Yes	INA	Yes
45	Clear screen	INA	INA	INA	INA	INA	Programmable	INA	Yes
46	Character overwrite	Yes	INA	INA	INA	INA	INA	INA	INA
47	Character insert	Optional	Yes	INA	Yes	INA	Yes	INA	Yes
48	Line insert	Optional	INA	INA	Yes	N/A	Yes	INA	Yes
49	Backspace	Yes	INA	INA	INA	No	INA	INA	INA
50	Forward tab	Yes	INA	INA	Yes	Yes	Yes	INA	Yes
51	Backward tab	Yes	INA	INA	Yes	Yes	Yes	INA	Yes
52	Adjust space and line automatically when characters, words, or sentences are added or deleted (word wrap)	INA	INA	INA	INA	INA	Yes	INA	INA
53	Automatically change paging when additions or deletions are made	INA	INA	INA	INA	INA	Yes	INA	INA
54	Clear unprotected data	INA	INA	INA	INA	INA	Programmable	INA	Yes
55	Scroll up or down	INA	INA	INA	Up or down	INA	Up or down	INA	Programmable
56	Audible alarm for end of line	INA	INA	INA	Yes	Yes	Yes	INA	INA
57	Audible alarm for end of page	INA	INA	INA	INA	INA	Yes	INA	INA
58	Automatic paging	No	INA	INA	INA	INA	Yes	INA	INA
59	Protected fields (programmable)	Yes	INA	INA	Yes	INA	Yes	INA	Yes
60	Cursor control from keyboard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	INA
61	Line number display	INA	INA	INA	INA	INA	INA	INA	INA
62	Column number display	INA	INA	INA	INA	INA	INA	INA	INA
63	Word search for delete or replace	INA	INA	INA	INA	INA	Yes	INA	INA
64	Next page	No	INA	INA	Yes	INA	Programmable	INA	INA
65	Previous page	No	INA	INA	INA	INA	Programmable	INA	INA
66	First page	No	INA	INA	INA	INA	Programmable	INA	INA
	Communication Interface and Control								
67	Type interface	EIA RS 232 C CCITT V.24 20/60 ma current loop	INA	RS-232 (Data) RS-170 (Video)	RS 232C	RS 232C Current loop Up to 19.2K Baud	Asynchronous, 2 wire direct Synchronous, Burroughs Direct Connect (BDC)	RS 232 CC 72 Long line	RS 232 Current lo... Asynchrono...
68	Transmission rates	75 to 19.2K Bps (RS-232-C) 75 to 9600 Bps (current loop) All rates are switch selectable 12 rates available		110 - 9600 Baud rates	Selectable up to 19,200 bps	Up to 19.2K Baud	Up to 9600 Bps - wire Up to 38,400 Bps - BDC	150, 300, 1200 and 1800 Baud asynchronous Up to 9600 Baud asynchronous 50% on long line	110 through 9... switchable
69	Transmission modes								
70	character at a time	Yes		INA	Yes	INA	Programmable	INA	Programmab...
71	line at a time	Yes		INA	Yes	INA	Programmable	INA	Programmab...
72	full screen at a time	Yes		INA	Yes	INA	Yes	INA	Programmab...
73	partial screen at a time	Yes		INA	INA	INA	Yes	INA	Programmab...
74	multiple pages at a time	No		INA	INA	INA	INA	INA	Programmab...
75	polling	INA		INA	INA	INA	Yes	Yes	Programmab...
76	**Military Specifications**	INA	INA	INA	INA	INA	INA	INA	INA
	Physical Dimensions			INA		INA			
77	Depth	23-1/8"	20.4"		26.0"		20	20.5"	20.2"
78	Width	21-3/8"	17.5"		20"		16.12"	17.5	17.5
79	Height	14-5/8"	14.4"		15.7"		15"	17.5	14.42
80	Weight	47 lbs. (approximately)	86 lbs.		60 lbs.		41 lbs	45 lbs	60 lbs.
	Power Requirements					INA			
81	Voltage (ac)	110	115/230 VAC ± 10%	230V optional	115 VAC ± 10%		100 - 240V	115/230V	105 to 260V
82	Current	1.0	INA	INA	INA		INA	INA	INA
83	Frequency	60 Hertz	50/60 Hertz	INA	60 Hertz		50 - 60 Hertz	50 - 60 Hertz	50/60 Hertz
84	Phase	INA	INA	INA	INA		INA	INA	INA
85	Watts	INA	100 (typical)	INA	INA		INA	200	200
	Environmental								
86	Operating			INA		INA	INA	INA	
87	temperature	0 to 50 deg. C	10° to 42°C		5° to 40°C				10° to 40°...
88	humidity (non-condensing)	10 to 95%	20 to 80%		INA				INA
89	Storage and shipping								
90	temperature	0 to 85 deg. C	-40° C to +71°C		INA				20° to 75...
91	humidity (non-condensing)	INA	5 - 95%	INA	INA	INA	INA	INA	INA
92	altitude	INA	INA	INA	INA	INA	INA	INA	INA
93	Equipment cooling method (convection or forced air)	INA	INA	INA	INA	INA	INA	INA	INA

INA – INFORMATION NOT AVAILABLE N/A – NOT APPLICABLE

4

	[illegible]	NA	NA	NA	Yes	NA	NA	NA	NA	NA
	No	None	None	INA	INA	No	NA	[illegible]	No	None
				INA	Key	Key and program	Key and program	Key	Key and program	Key
...r program	Program and key	Key, Program	Key & Program	INA	Underline or blinking underline	INA	Blinking	INA	Blinking underline	INA
	Blinking	NA	Blinking, Underline	INA	INA	Yes				
	Yes	[illegible]	Yes	INA	INA	5 X 8	Yes	INA	Yes	NA
	5 X 7	[illegible] X 9	7 X 9	INA	Lights	INA	INA	7 X 11	7 X 7	7 X 9
	25th line on CRT	NA	INA	INA	Yes	INA	INA	INA	INA	[illegible]
							INA	INA	INA	NA
	50 or 60 Hertz	50 or 60 Hertz	INA	INA	INA	INA	INA	INA	INA	NA
	P 4	P 4	INA	INA	INA	P-4	INA	P 31	P-4	NA
	7000 characters 1 page additional 7000 characters [illegible]	INA	INA	100 pages per diskette	INA	INA	7920 characters 2 pages	INA	INA	NA
	Yes	Yes	INA	INA	INA	Yes	INA	Yes	INA	INA
	Yes	Yes	INA	INA	INA	INA	NA	Yes	INA	INA
	Yes	Optional	Yes	INA	INA	INA	Yes	Yes	INA	INA
	Yes	Optional	Yes	INA	INA	INA	Yes	Yes	INA	INA
	Yes	NA	INA	INA	INA	Yes	INA	Yes	INA	INA
	INA	Yes	INA	INA	INA	NA	Yes	INA	INA	NA
	Yes	Optional	Yes	INA	INA	INA	Yes	Yes	INA	NA
	Yes	Optional	Yes	INA	INA	INA	Yes	Yes	NA	NA
	INA	NA	INA	INA	INA	INA	Yes	INA	INA	NA
	Yes	Optional	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes
	Yes	Optional	INA	INA	Yes	INA	INA	No	NA	NA
	INA	NA	INA	INA	INA	INA	INA	INA	NA	NA
	INA	NA	INA	Optional	INA	INA	INA	INA	INA	NA
	Yes	NA	INA	INA	INA	INA	INA	INA	NA	NA
	Programmable	NA	Optional	Scroll up	INA	INA	Yes	Yes	Yes	Yes
	INA	NA	Yes	INA	INA	INA	INA	INA	INA	NA
	INA	NA	Yes	INA	INA	INA	INA	INA	INA	NA
	INA	NA	INA	Yes	INA	INA	INA	INA	INA	NA
	Yes	Optional	Yes	INA	Yes	INA	Yes	INA	INA	NA
	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
	INA	NA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	NA	INA	INA	INA	INA	INA	INA	INA	NA
	INA	NA	INA	INA	INA	INA	INA	INA	INA	NA
	INA	NA	INA	INA	INA	INA	INA	INA	INA	NA
	INA	NA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	NA	INA	INA	INA	INA	INA	INA	INA	INA
...ong line ...0 1200 and 1800 Baud ...onous	RS 232 Current loop Asynchronous or synchronous	RS 232 20 ma current loop (optional)	RS 232 C CCITT V 24	INA	INA	20 ma current loop RS 232 C	RS 232 C 20 milliamp current loop	RS 232 C CCITT	RS 232 20 ma current loop	EIA 20 ma optional
...600 Baud asynchronous ...n long line	110 through 9600 Baud switchable	Up to 9600 Baud	110 150 300 600 1200 1800 2400 4800 9600 Baud	INA	Up to 9600 Bps	10 rates up to 19.2 Kbps	110 150 300 600 1200 2400 4800 9600 Bps	9600 Baud asynchronous, over 20,000 Baud synchronous	75 110 300 600 1200 2400 4800 9600 Baud	Up to 19,200 Baud
	Programmable	Yes	INA	INA	INA	INA	Yes	INA	INA	INA
	Programmable	NA	INA	INA	INA	INA	Yes	INA	INA	INA
	Programmable	Yes	INA	INA	INA	INA	Yes	INA	INA	INA
	Programmable	NA	Optional	INA	INA	INA	INA	INA	INA	INA
	Programmable	NA	INA	INA	INA	INA	INA	INA	INA	INA
	Programmable	NA	Optional	INA	INA	INA	Optional	Yes	INA	INA
	INA	NA	INA	INA	INA	INA	INA	INA	INA	INA
	28.2"	20.5	20.1"	25-3/4"	INA	22"	INA	19-1/2"	27.2	20"
	17.5"	21.7	21.7"	24-1/2"	INA	22"	INA	21-1/2"	20.9	INA
	14.42"	15.2	15.7"	19"	INA	17.5"	INA	13"	14.1"	INA
	60 lbs.	51 lbs	62 lbs.	110 lbs.	INA	52 lbs	INA	30 to 45 lbs.	61 lbs.	INA
...V	105 to 280V	117 220/240 ± 10%	120 Vac / 220/240 Vac	100 to 260V	INA	$120^{+10\%}_{-15\%}$	INA	120V 240V	115V	90 180V 180-25[illegible]
	INA	1.0 Amp at 117V, 0.5 Amp at 220/240V	1.5 Amps / 1.0 Amp	INA	INA	INA	INA	INA	INA	INA
Hertz	50/60 Hertz	50/60 Hertz	50/60 Hertz / 50 Hertz	50/60 Hertz	INA	60 Hertz	INA	60/50 Hertz	60 Hertz	47-63 Hertz
	INA	INA	INA	INA	INA	Single	INA	INA	INA	INA
	200	INA	INA	INA	INA	115	INA	Less than 200	185	INA
	10° to 40° C	10° to 40° C	10° to 40° C	INA	INA	0°-45° C	INA	INA	10° C to 40° C	INA
	INA	20 to 80%	20 to 80%	INA	INA	10%-95%	INA	INA	10 to 90%	INA
	-20° to 75° C	INA	INA	INA	INA	INA	INA	INA	-40° C to 66° C	INA
	INA	INA	INA	INA	INA	INA	INA	INA	0 to 95%	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	Convection Cooling	Convection Cooling	INA	INA	Convection	INA	INA	INA	INA

	NA	Yes	[illegible]	[illegible]	NA	NA	[illegible]	NA	[illegible]	
	INA	NA	[illegible]	[illegible]	[illegible]	No	None	[illegible]	None	
	INA	Yes	Keyboard [illegible]	[illegible]	Yes	Key and program	Yes			
	INA	Underline [illegible]	NA	[illegible]	INA	Blinking underline	INA			
	INA	INA	[illegible]					Keyboard [illegible] Blinking underline	Keyboard [illegible] [illegible]	
	INA	INA	[illegible]	Yes	INA	Yes	NA	Yes	Yes	
	INA	Lights	NA	NA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	INA	Yes	NA	NA	INA	INA	[illegible]	NA	Yes	
				NA	INA	INA	NA	NA	NA	
	INA	NA	NA	NA	INA	INA	NA	60 Hertz	50 or 60 Hertz	
	INA	INA	P4	NA	P31	P4	NA	P31 P4 optional	P4	
	00 pages per diskette	INA	NA	1920 characters 2 pages	INA	INA	NA	2048 Characters	INA	
	INA	NA	Yes	NA	Yes	INA	INA	INA	Yes	
	INA	NA	NA	NA	Yes	INA	NA	NA	Yes	
	INA	NA	NA	Yes	Yes	INA	NA	Yes	Yes	
	INA	NA	NA	Yes	Yes	INA	NA	Yes	Yes	
	INA	NA	Yes	NA	Yes	INA	NA	Yes	Yes	
	INA	NA	NA	Yes	INA	INA	NA	INA	NA	
	INA	NA	NA	Yes	Yes	INA	NA	Yes	Yes	
	INA	NA	NA	Yes	Yes	NA	NA	Yes	Yes	
	INA	INA	N	Yes	INA	INA	NA	NA	Yes	
	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	
	INA	Yes	NA	NA	No	INA	NA	Yes	Yes	
	INA	NA	NA	NA	INA	INA	NA	INA	NA	
	Optional	INA	NA	NA	INA	INA	NA	INA	NA	
	INA	NA	NA	NA	INA	INA	INA	INA	Yes	
	Scroll up	INA	NA	Yes	Yes	Yes	Yes	Scroll up	Yes	
	INA	INA	NA	NA	INA	NA	INA	Yes	NA	
	INA	INA	NA	NA	INA	INA	INA	INA	NA	
	Yes	INA	NA	NA	INA	INA	INA	NA	NA	
	INA	Yes	NA	Yes	INA	INA	INA	INA	Yes	
	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	INA	INA	NA	NA	INA	INA	INA	INA	NA	
	INA	INA	NA	NA	INA	INA	INA	INA	INA	
	INA	INA	INA	NA	INA	INA	INA	De Model 4300	INA	
	INA	INA	INA	INA	INA	INA	INA	Yes	INA	
	INA	INA	NA	NA	INA	INA	INA	Yes	INA	
	INA	INA	NA	INA	INA	INA	INA	No	INA	
	INA	INA	20 ma current loop RS 232 C	RS 232 20 ma current loop	RS-232 C CCITT	RS 232 20 ma current loop	EIA 20 ma optional	RS 232 C	RS 232 C 20 ma current loop	
1200 1800 aud	INA	Up to 9600 Bps	10 rates up to 19.2 Kbps	110 150 300 600 1200 2400 4800 9600 Bps	9600 Baud asynchronous, over 20,000 Baud synchronous	75 110 300 600 1200 2400 4800 9600 Baud	Up to 19,200 Baud	Up to 9600 Baud synchronous or asynchronous	50 through 19,200 Bps in 16 steps	
	INA	INA	INA	Yes	INA	INA	INA	INA	INA	
	INA	INA	INA	Yes	INA	INA	INA	INA	INA	
	INA	INA	INA	Yes	INA	INA	INA	INA	Yes	
	INA	INA	INA	INA	INA	INA	INA	INA	Yes	
	INA	INA	INA	INA	INA	INA	INA	INA	INA	
	INA	INA	INA	Optional	Yes	INA	INA	Yes	Yes	
	INA	INA	INA	INA	INA	INA	INA	INA	INA	
	75 1 4	INA	22	INA	19 1/2"	27.2"	20"	27	23.5	
	74 1 2	INA	22"	INA	21 1/2"	20.9"	INA	18 1/8	19	
	9	INA	17.5"	INA	13"	14.1"	INA	15 3/4	16.5	
	8 lbs	INA	52 lbs	INA	30 to 45 lbs	61 lbs	INA	80 lbs	INA	
[illegible]	[illegible]	INA	$120^{+10\%}_{-15\%}$	INA	120V/240V	115V	90-180V 180-256V	115V	115V ±10%	230V ±10%
	[illegible]	NA	INA	INA	INA	INA	INA	INA	INA	INA
	[illegible]	NA	60 Hertz	INA	60/50 Hertz	60 Hertz	47-63 Hertz	60 Hertz	60 Hertz	50 Hertz
	[illegible]	NA	Single	INA	INA	INA	INA	INA	INA	INA
	[illegible]	NA	115	INA	Less than 200	185	INA	250	INA	INA
		-	0 45 C	INA	INA	10 C to 40 C	INA	10 C to 40 C	5 40 C	
		-	10% 95%	INA	INA	10 to 90%	INA	INA	10 90%	
			NA	INA	INA	-40 C to 66 C	INA	INA	INA	
			NA	INA	INA	0 to 95%	INA	INA	INA	
			NA	INA	INA	INA	INA	INA	INA	
			[illegible]	NA	INA	INA	INA	INA	INA	

1	Item Number	20	21	22	23	24	25	26	27	
2	Manufacturer	Honeywell Information Systems	Human Designed Systems Inc	IMSAI Manufacturing Corp	Jacquard Systems	Hazeltine Corp Computer Terminal Equipment	Hewlett Packard	INFOTRON	INFOTRON	[illegible]
3	Model Number	VIP 7205	CONCEPT 100	VDP 80	J100 Videocomputer	Modular One/Polling	2645A	400	VISTAR 3	BC[illegible]
4	Cost Range	INA	INA	$8995	INA	INA	$3500 to $7000	INA	INA	$44[illegible]
5	Available options	Features of VIP 7100/7105 or VIP 7200	Multiple character sets additional function keys		Expansion to 128K Bytes of storage					
	Keyboard									
6	Typewriter keypad	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Numeric keypad	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Cursor control keypad	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
9	General purpose function keys (user defined)	Yes	Yes	INA	Yes	Yes	Yes	Yes	No	Yes
10	Edit keys	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
11	TTY keyboard	Yes	No	INA	No	INA	No	INA	INA	NA
12	Key modes	INA	INA	INA	INA	INA	INA	INA	INA	NA
13	Detachable keyboard	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
14	Repeat on keys	INA	Yes	INA	INA	INA		INA	INA	NA
15	N-key rollover	Yes	INA	Yes	Yes	INA	Yes	INA	Yes	NA
16	Keylock switch	INA	INA	INA	INA	INA	INA	INA	INA	NA
17	Lighted keys	INA	INA	INA	INA	INA	INA	INA	INA	NA
	Display Capability									
18	Non-glare screen	INA	Yes	INA	Yes	Yes	INA	Yes	Yes	NA
19	Character set	128 ASCII and control	128 ASCII	256	Full ASCII	128 ASCII	128	128 ASCII	128 ASC	64 A[illegible]
20	Tilt screen	No	Yes	No	No	No	No	No	No	No
21	Swivel screen	No	Yes	No	No	No	No	No	No	No
22	Programmable brightness	Yes	Yes	INA	INA	Yes	Yes	INA	INA	NA
23	No. of levels	Two	Two	INA	INA	Two	Two	INA	INA	NA
24	Number of lines	24	24	24	24	24	24	24	24	24
25	Characters per line	80	80	80	80	80	80	80	80	80
26	Reverse video (programmable)	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	NA
27	Blinking (programmable)	INA	Yes	INA	INA	Yes	Yes	Yes	Yes	NA
28	Screen size	12" diagonal	12" diagonal	12" diagonal	12" diagonal	12" diagonal	5" X 10"	12" diagonal	12" diagonal	13[illegible]
29	Non-display field for security	INA	INA	INA	INA	Yes	INA	INA	INA	NA
30	Color display capability	None	None	None	INA	None	None	None	None	[illegible]
31	Cursor									
32	control (key, program or both)	Key and program	Key and program	INA	Key	Key and program	Key	Key and program	Key	Key[illegible]
33	type (blinking, underline, reverse video, etc.)	Reverse video and blinking	Blinking underline or blinking reverse video	INA	INA	Block or underline	Blinking underline	INA	INA	White [illegible] underline
34	addressable	Yes	Yes	INA	INA	Yes	INA	Yes	INA	NA
35	Dot Matrix for characters (8 X 10, 10 X 16, etc.)	5 X 7	7 X 9	INA	INA	7 X 9	7 X 9	9 X 9	5 X 7	5 X [illegible]
36	Status displays (lights or line on CRT)	INA	Line on CRT	INA	INA	Lights	INA	INA	INA	NA
37	Flicker free	INA		INA	Yes	Yes				
38	refresh screen data rate	60 Hertz	60 Hertz	INA	INA	60 Hertz	60 Hertz	50 or 60 Hertz	50 or 60 Hertz	60 times[illegible]
39	phosphor type (e.g., P-4)	INA	P-4	INA	INA	P-4	P-4	P-4	P-4	NA
40	Memory size for display	1920 characters	INA	INA	INA	INA	11,000 bytes	INA	INA	48[illegible]
	Compose and Edit Features									
41	Erase to end of line	Yes	Yes	INA	INA	Yes	INA	INA	INA	INA
42	Erase to end of page	Yes	Yes	INA	INA	INA	INA	INA	INA	INA
43	Character delete	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
44	Line delete	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
45	Clear screen	INA	Yes	INA	INA	Yes	Yes	Yes	Yes	INA
46	Character overwrite	INA	INA	INA	INA	INA	INA	INA	INA	INA
47	Character insert	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
48	Line insert	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes
49	Backspace	INA	Yes	INA	INA	Yes	Yes	Yes	No	INA
50	Forward tab	INA	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
51	Backward tab	INA	Yes	INA	Yes	Yes	No	Yes	Yes	INA
52	Adjust space and line automatically when characters, words, or sentences are added or deleted (word wrap)	INA	INA	INA	INA	INA	INA	INA	INA	INA
53	Automatically change paging when additions or deletions are made	INA	INA	INA	INA	INA	INA	INA	INA	INA
54	Clear unprotected data	INA	Yes	INA	INA	Yes	INA	INA	INA	INA
55	Scroll up or down	Up Mode	Up or down	INA	INA	INA	up or down	INA	Scroll up	Scr[illegible]
56	Audible alarm for end of line	Yes	INA	INA	INA	INA	INA	INA	INA	INA
57	Audible alarm for end of page	INA	INA	INA	INA	INA	INA	INA	INA	INA
58	Automatic paging	INA	INA	INA	INA	INA	INA	INA	INA	INA
59	Protected fields (programmable)	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	INA
60	Cursor control from keyboard	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes
61	Line number display	INA	INA	INA	INA	INA	INA	INA	Yes	INA
62	Column number display	INA	INA	INA	INA	INA	INA	INA	INA	INA
63	Word search for delete or replace	INA	INA	INA	INA	INA	INA	INA	INA	INA
64	Next page	INA	Yes	INA	INA	INA	Yes	INA	INA	INA
65	Previous page	INA	Yes	INA	INA	INA	Yes	INA	INA	INA
66	First page	INA	INA	INA	INA	INA	No	INA	INA	INA
	Communication Interface and Control									
67	Type interface	RS-232-C 20 ma current loop or 60 ma current loop	RS-232-C 20 ma current	INA	INA	RS-232	RS-232 20 ma current loop	RS-232-C 20 or 60 ma current loop	RS-232-C 20 or 60 ma current loop	RS 232
68	Transmission rates	75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 Baud rates selectable	50 - 9600 Baud (15 rates)	0.05 to 50 Kilobaud		110, 200, 300, 600, 1200, 2400, 4800, 9600 Baud	110, 150, 300, 1200, 2400 4800, 9600 Baud	50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 19,200 bits per second	50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits per second	110 Baud [illegible] (14 rates)
69	Transmission modes									
70	character at a time	Yes	Yes	INA	INA	INA	INA	INA	Yes	INA
71	line at a time	Yes	INA	INA	INA	INA	INA	INA	No	INA
72	full screen at a time	Yes	INA	INA	INA	INA	INA	Yes	Yes	INA
73	partial screen at a time	INA	INA	INA	INA	INA	INA	Yes	Yes	INA
74	multiple pages at a time	INA	INA	INA	INA	INA	INA	INA	INA	INA
75	polling	INA	INA	INA	INA	Yes	INA	Optional	INA	INA
76	Military Specifications	INA	INA	INA	INA	INA	INA	INA	INA	INA

27	28	29	30	31	32	33	34	35	36
INFOTRON	Intelligent Systems Corp	Interstate Electronics Corp	Lear Siegler Inc Electronic Instrumentation Division	Lear Siegler Inc Electronic Instrumentation Division	Magnavox Fort Wayne Ind	Megadata Corp	Megadata Corp	Mini-Computer Systems Inc Peripheral Products Division	Omron Corp of America Information Products Division
VISTAR 3	8051	PD 3000	ADM 2	VDP 400	ORION 60	MC77	System 700	Model [illegible]	8036
INA	$4495 to $5995	INA	INA	$3995 to $8295	$5300 to $7296	INA	INA	INA	INA
		Graphics			Graphics and projection				
Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	INA	Yes	Yes	Yes	No	INA	Yes	Yes
Yes	Yes	INA	Yes	Yes	Yes	Yes	INA	Yes	Yes
No	Yes	INA	Yes	Yes	No	Yes	Yes	Yes	INA
Yes	Yes	INA	Yes	Yes	No	Yes	INA	Yes	Yes
INA	INA	INA	INA	No	INA	No	INA	INA	No
INA	INA	INA	INA	INA	Yes	INA	INA	INA	Yes
Yes	Yes	Yes	Yes	Yes	No	No	Yes	INA	No
INA	INA	INA	Yes	INA	INA	INA	INA	INA	INA
Yes	INA	INA	INA	INA	Yes	INA	Two key rollover	INA	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	Yes	Yes	INA	INA	INA	INA
Yes	INA	INA	Yes	Yes	INA	Yes	Yes	INA	INA
128 ASCII	64 ASCII	INA	128 ASCII	128 ASCII	96 ASCII	128 ASCII	64	96 ASCII	128 ASCII
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
INA	INA	INA	Yes	Yes	No	Yes	Yes	Yes	Yes
INA	INA	INA	Two	Two	No	Two	Two	Two	Two
24	25	32 or 51	24	25	32 or 51	24	24 up to 32	24	24
80	80	64 or 85	80	80	64 or 85	80	80	80	80
Yes	INA	INA	INA	Yes	Yes	INA	Yes	Yes	Yes
Yes	INA	INA	INA	Yes	INA	Yes	Yes	Yes	Yes
12" diagonal	13" diagonal	12 1/4" X 12 1/4" (plasma)	12" diagonal	15" diagonal	8 1/2" X 8 1/2"	12" diagonal	15" diagonal	12" diagonal	15" diagonal
INA	INA	INA	Yes	INA	INA	Yes	Yes	INA	INA
None	8 colors	Neon Orange	No	None	INA	Green	Optional	None	None
Key	Key	INA	Key and program	Key	Key and program	Key	Program	Key and program	Key and program
INA	White blinking overscore underscore	Inverted L	INA	INA	Underline	Blinking block	Underscore optional blinking block	Block or underscore	Blinking underscore or block
INA	INA	INA	Yes	INA	Yes	INA	Yes	Yes	INA
5 X 7	5 X 7	7 X 9 or 5 X 7	5 X 9	7 X 9	7 X 9 or 5 X 7	7 X 9	7 X 8	7 X 9	7 X 7 or 7 X 9
INA	INA		CRT lines	25th line on CRT	INA	Lights	Lights	INA	INA
		Yes			Yes	INA			
50 or 60 Hertz	60 times/second	INA	60 fields per second	60 Hertz	INA	INA	60 fields per second	INA	60 Hertz
P-4	INA	INA	P-4	INA	INA	P-31	INA	P-4	P-4
INA	48 lines of 80 characters/line	4335 characters (5 X 7) 2048 characters (7 X 9)	INA	INA	INA	INA	INA	INA	1920 characters std; up to 19,200 characters optional
INA	INA	INA	INA	INA	INA	INA	INA	Yes	Yes
INA	INA	INA	INA	INA	INA	INA	INA	Yes	Yes
Yes	Yes	INA	Yes	Yes	Yes	Programmable	INA	Yes	Yes
Yes	Yes	INA	Yes	Yes	INA	No	INA	Yes	Yes
Yes	INA	Yes	Yes	Yes	Yes	INA	INA	Yes	Yes
INA	INA	INA	INA	INA	Yes	INA	INA	INA	INA
Yes	Yes	INA	Yes	Yes	Yes	Programmable	INA	Yes	Yes
Yes	Yes	INA	Yes	Yes	INA	INA	INA	Yes	Yes
No	INA	INA	INA	No	Yes	INA	INA	Yes	INA
Yes	Yes	INA	Yes	Yes	Yes	INA	INA	Yes	Yes
Yes	INA	INA	INA	Yes	INA	INA	INA	Yes	INA
INA	INA	INA	INA	INA	INA	Programmable	INA	INA	INA
INA	INA	INA	INA	INA	INA	Programmable	INA	INA	INA
INA	INA	INA	INA	INA	INA	INA	INA	Yes	INA
Scroll up	Scroll up	INA	INA	Up or down	INA	Programmable	INA	INA	Up or down
INA	INA	INA	INA	INA	INA	INA	INA	INA	Programmable
INA	INA	INA	INA	INA	INA	INA	INA	INA	Programmable
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Yes	INA	INA	Yes	Yes	INA	Yes	INA	Yes	Yes
Yes	Yes	INA	Yes	Yes	Yes	Yes	INA	Yes	Yes
Yes	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	INA	INA	INA	Programmable	INA	INA	INA
INA	INA	INA	INA	Yes	INA	INA	INA	INA	Yes
INA	INA	INA	INA	Yes	INA	INA	INA	INA	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
RS-232-C 20 or 60 ma current loop	RS-232-C	MIL-STD-188C RS-232-C	RS-232-C	RS 232 C	RS-232	RS-232-C RS-422	INA	RS-232-B RS-232-C Current loop	RS-232-C 20/60 ma current loop optional
50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits per second	110 Baud to 76.8K Baud (14 rates)	150 to 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800, 9600 Baud	75 to 9600 Baud	50 to 2400 Baud	Serial data up to 38.4K Baud; Special parallel, up to 10,000 character/sec.	50 to 38,400 Baud serial, 20,000 characters per second parallel	110, 300, 600, 1200, 2400, 4800, 9600, 19,200 Baud	Up to 9600 Baud
Yes	INA	INA	INA	Yes	Yes	INA	INA	INA	Yes
No	INA	INA	Yes	Yes	INA	INA	INA	INA	Yes
Yes	INA	INA	Yes	Yes	INA	INA	INA	INA	Yes
Yes	INA	INA	Yes	Yes	INA	INA	INA	INA	Yes
INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	INA	Yes	Optional	INA	INA	INA	INA	INA
INA	INA	MIL-STD-188C MIL-STD-810 Drip Test MIL-STD-461 Notice 3 MIL-STD-810C Shock Test MIL-E-5400R Vibration	INA	INA	INA	INA	INA	INA	INA

[illegible]	[illegible]									
30	Color display capability	[illegible]	None	None	N/A	None	None	[illegible]	None	
31	Cursor									
32	control (key, program or both)	Key and program	Key and program	INA	Key	Key and program	Key	Key and program	Key	
33	type (blinking, underline, reverse video, etc.)	Reverse video and blinking	Blinking underline or blinking reverse video	INA	INA	Block or underline	Blinking underline	N/A	N/A	
34	addressable	Yes	Yes	INA	INA	Yes	INA	Yes	N/A	
35	Dot Matrix for characters (8 x 10, 10 x 16, etc.)	5 x 7	7 x 9	INA	INA	7 x 9	[illegible]	[illegible]	5 x 7	
36	Status displays (lights or line on CRT)	N/A	Line on CRT	INA	INA	Lights	N/A	N/A	N/A	
37	Flicker free	N/A		INA	Yes	Yes				
38	refresh screen data rate	60 Hertz	60 Hertz	INA	INA	60 Hertz	60 Hertz	50 or 60 Hertz	50 or 60 Hertz	
39	phosphor type (e.g. P-4)	N/A	P 4	INA	INA	P 4	P 4	P 4	P 4	
40	Memory size for display	1920 characters	INA	INA	INA	INA	[illegible] 000 bytes	INA	INA	
	Compose and Edit Features									
41	Erase to end of line	Yes	Yes	INA	INA	Yes	INA	INA	INA	
42	Erase to end of page	Yes	Yes	INA	INA	INA	INA	INA	INA	
43	Character delete	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
44	Line delete	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
45	Clear screen	INA	Yes	INA	INA	Yes	Yes	Yes	Yes	
46	Character overwrite	INA	INA	INA	INA	INA	INA	N/A	N/A	
47	Character insert	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
48	Line insert	N/A	Yes	Yes	INA	Yes	Yes	Yes	Yes	
49	Backspace	N/A	Yes	INA	INA	Yes	Yes	Yes	No	
50	Forward tab	N/A	Yes	INA	Yes	Yes	Yes	Yes	Yes	
51	Backward tab	N/A	Yes	INA	Yes	Yes	No	Yes	Yes	
52	Adjust space and line automatically when characters, words, or sentences are added or deleted (word wrap)	N/A	INA	INA	INA	INA	INA	N/A	N/A	
53	Automatically change paging when additions or deletions are made	INA	INA	INA	INA	INA	INA	N/A	INA	
54	Clear unprotected data	INA	Yes	INA	INA	Yes	INA	N/A	INA	
55	Scroll up or down	Up Mode	Up or down	INA	INA	INA	up or down	N/A	Scroll up	
56	Audible alarm for end of line	Yes	INA	INA	INA	INA	INA	N/A	INA	
57	Audible alarm for end of page	INA	INA	INA	INA	INA	INA	N/A	INA	
58	Automatic paging	INA	INA	INA	INA	INA	INA	N/A	INA	
59	Protected fields (programmable)	INA	Yes	Yes	INA	Yes	Yes	Yes	Yes	
60	Cursor control from keyboard	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	
61	Line number display	INA	INA	INA	INA	INA	INA	N/A	Yes	
62	Column number display	INA	INA	INA	INA	INA	INA	INA	INA	
63	Word search for delete or replace	INA	INA	INA	INA	INA	INA	INA	INA	
64	Next page	INA	Yes	INA	INA	INA	Yes	INA	INA	
65	Previous page	INA	Yes	INA	INA	INA	Yes	INA	INA	
66	First page	INA	INA	INA	INA	INA	No	INA	INA	
	Communication Interface and Control									
67	Type interface	RS-232 C 20 ma current loop or 60 ma current loop	RS-232 C 20 ma current	INA	INA	RS 232	RS 232 20 ma current loop	RS 232 C 20 or 60 ma current loop	RS 232 C 20 or 60 ma current loop	
68	Transmission rates	75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 Baud rates selectable	50 - 9600 Baud (15 rates)	0.05 to 56 Kilobaud		110, 200, 300, 600, 1200, 2400, 4800, 9600 Baud	110, 150, 300, 1200, 2400, 4800, 9600 Baud	50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 19,200 bits per second	50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits per second	
69	Transmission modes									
70	character at a time	Yes	Yes	INA	INA	INA	INA	INA	Yes	
71	line at a time	Yes	INA	INA	INA	INA	INA	INA	No	
72	full screen at a time	Yes	INA	INA	INA	INA	INA	Yes	Yes	
73	partial screen at a time	INA	INA	INA	INA	INA	INA	Yes	Yes	
74	multiple pages at a time	INA	INA	INA	INA	INA	INA	INA	INA	
75	polling	INA	INA	INA	INA	Yes	INA	Optional	INA	
76	**Military Specifications**	INA	INA	INA	INA	INA	INA	INA	INA	
	Physical Dimensions									
77	Depth	23-3/4"	24-1/4"	INA	20"	22"	25.5"	24	16	
78	Width	18.12"	17-1/2"	INA	23.5"	22"	17.5"	19	17"	
79	Height	13.12"	18"	INA	17.5"	17.5"	13.5"	13	13"	
80	Weight	39 lbs.	INA	INA	90 lbs.	50 lbs.	50 lbs.	INA	35 lbs.	
	Power Requirements									
81	Voltage (ac)	INA	INA	INA	INA	115V	115 + 10% - 23%	90 to 150	INA	105
82	Current	INA	INA	INA	INA	INA	INA	INA	INA	
83	Frequency	INA	INA	INA	INA	60 Hertz	60 Hertz	50 or 60 Hertz	INA	60
84	Phases	INA	INA	INA	INA	INA	INA	INA	INA	
85	Watts	INA	INA	INA	INA	200	85 to 140	120	INA	250
	Environmental									
86	Operating									
87	temperature	INA	INA	INA	INA	10° to 40° C	0° to 55° C	5° to 40° C	0° C to 50° C	-10
88	humidity (non-condensing)	INA	INA	INA	INA	up to 95%	5 to 95%	5 to 80%	0% to 95%	0 to
89	Storage and shipping									
90	temperature	INA	INA	INA	INA	-20° to 70° C	-40 to 75° C	-30° to 65° C	INA	-30
91	humidity (non-condensing)	INA	INA	INA	INA	INA	INA	INA	INA	INA
92	altitude	INA	INA	INA	INA	INA	25,000 feet	INA	INA	INA
93	Equipment cooling method (convection or forced air)	INA	INA	INA	INA	INA	INA	INA	INA	INA

INA – INFORMATION NOT AVAILABLE   N/A – NOT APPLICABLE

	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	None	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Key	Key	INA	Key and program	[illegible]	Key and program	Key	Program	Key and program	Key and program
	INA	White blinking overscore underscore	Inverted	INA	[illegible]	Underline	Blinking block	Underscore, optional blinking block	Block or underscore	Blinking underscore or block
	INA	INA	INA	Yes	[illegible]	Yes	INA	Yes	Yes	NA
	5 X 7	5 X 7	7 X 9 or 5 X 7	5 X 9	[illegible]	7 X 9 or 5 X 7	7 X 9	7 X 9	7 X 9	[illegible]
	INA	INA		CRT lines	[illegible] CRT	INA	Lights	Lights	NA	NA
			Yes			Yes	INA			
	50 or 60 Hertz	60 times second	INA	60 fields per second	[illegible]	INA	INA	60 fields per second	INA	60 Hertz
	P-4	INA	INA	P 4	NA	INA	P 31	INA	P 4	P 4
	INA	48 lines of 80 characters/line	4335 characters (5 X 7 2048 characters (7 X 9	INA	NA	INA	INA	INA	NA	1920 characters std., up to 10,200 characters optional
	INA	INA	INA	INA	NA	INA	INA	NA	Yes	Yes
	INA	INA	INA	INA	NA	INA	INA	NA	Yes	Yes
	Yes	Yes	INA	Yes	Yes	Yes	Programmable	INA	Yes	Yes
	Yes	Yes	INA	Yes	Yes	INA	No	INA	Yes	Yes
	Yes	INA	Yes	Yes	[illegible]	Yes	INA	INA	Yes	Yes
	INA	INA	INA	INA	[illegible]	Yes	INA	INA	INA	INA
	Yes	Yes	INA	Yes	[illegible]	Yes	Programmable	INA	Yes	Yes
	Yes	Yes	INA	Yes	[illegible]	INA	INA	INA	Yes	Yes
	No	INA	INA	INA	[illegible]	Yes	INA	INA	Yes	INA
	Yes	Yes	INA	Yes	[illegible]	Yes	INA	INA	Yes	Yes
	Yes	INA	INA	INA	[illegible]	INA	INA	INA	Yes	INA
	INA	INA	INA	INA	NA	INA	Programmable	INA	INA	INA
	INA	INA	INA	INA	NA	INA	Programmable	INA	INA	NA
	INA	INA	INA	INA	NA	INA	INA	INA	Yes	NA
	Scroll up	Scroll up	INA	INA	[illegible] down	INA	Programmable	INA	INA	Up or down
	INA	INA	INA	INA	NA	INA	INA	INA	INA	Programmable
	INA	INA	INA	INA	NA	INA	INA	INA	INA	Programmable
	INA	INA	INA	INA	NA	INA	INA	INA	INA	INA
	Yes	INA	INA	Yes	Yes	INA	Yes	INA	Yes	Yes
	Yes	Yes	INA	Yes	Yes	Yes	Yes	INA	Yes	Yes
	Yes	INA	INA	INA	NA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	NA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	NA	INA	Programmable	INA	INA	INA
	INA	INA	INA	INA	Yes	INA	INA	INA	INA	Yes
	INA	INA	INA	INA	Yes	INA	INA	INA	INA	Yes
	INA	INA	INA	INA	NA	INA	INA	INA	INA	INA
[illegible]t loop	RS-232-C 20 or 60 ma current loop	RS-232-C	MIL STD 188C RS-232-C	RS-232 C	RS-232 C	RS-232	RS-232-C RS-422	INA	RS-232 B RS-232-C Current loop	RS-232 C 20/60 ma current loop optional
[illegible] 150, 200 [illegible]00, 2400, 9600 [illegible]nd	50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600 bits per second	110 Baud to 76.8K Baud (14 rates)	150 to 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800, 9600 Baud	75 to 9600 Baud	50 to 2400 Baud	Serial data up to 38.4K Baud. Special parallel, up to 10,000 character sec	50 to 38,400 Baud serial. 20,000 characters per second parallel	110, 300, 600, 1200, 2400, 4800, 9600, 19,200 Baud	Up to 9600 Baud
	Yes	INA	INA	INA	Yes	Yes	INA	INA	INA	Yes
	No	INA	INA	Yes	Yes	INA	INA	INA	INA	Yes
	Yes	INA	INA	Yes	Yes	INA	INA	INA	INA	Yes
	Yes	INA	INA	Yes	Yes	INA	INA	INA	INA	Yes
	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	Yes	Optional	INA	INA	INA	INA	INA
	INA	INA	MIL-STD-188C MIL-STD-810 Drip Test MIL-STD-461 Notice 3 MIL-STD-810C Shock Test MIL-E-5400R Vibration	INA	INA	INA	INA	INA	INA	INA
	16"	25-1/4"	20.5"	24"	25.38	27"	18"	25"	17-1/2"	23"
	17"	21"	19"	20-1/2"	18.88	19.5"	18"	22"	18-3/4"	17"
	13"	15-1/2"	14"	12-1/2"	18	20"	16"	17"	14"	16"
	35 lbs.	75 lbs.	65 lbs.	50 lbs.	65 lbs	78 lbs.	40 lbs.	60 lbs.	INA	INA
	INA	105-125	115 ± 10V	115 VAC, 230 optional	115V	115V	115 or 230V	INA	INA	INA
	INA	INA		INA	INA	INA	INA	INA	INA	INA
	INA	60 Hertz	50-60 Hertz, 400 Hertz opt.	60 Hertz, 50 Hertz optional	60 Hertz	60 Hertz	50 Hertz	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	250	220	INA	225	200 Max	INA	INA	INA	INA
	0°C to 50°C	+10°C to 40°C	-20°C to 55°C	INA	INA	INA	INA	INA	INA	INA
	0% to 95%	0 to 95%	Up to 95%	INA	INA	INA	INA	INA	INA	INA
	INA	-30°C to 70°C	-62°C to +85°C	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	Up to 70,000 ft.	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA

#	Item Number	37	38	39	40	41	42	43
2	Manufacturer	Ontel Corp	Perkins Elmer Data System Terminal Division or INTERDATA	Racal Milgo (ICC)	SOROC	Systematics General Corp NSL Division	Systematics General Corp NSL Division	Tano Corp
3	Model Number	OP 1 series	OWL 1200 1200 Series T	40+ Data Display System	IQ 120 Terminal	T5101	T5145	Outpost 11 includes one floppy disc drive
4	Cost Range	INA	INA	INA	INA	$4950 $8500	$5950 $10,000	$1995
5	Available options					Tempest isolation. Polling and addressing	Integrated dual cassette drives	expandable memory to 64K bytes
	Keyboard							
6	Typewriter keypad	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Numeric keypad	Yes	Yes	No	Yes	Yes	Yes	Yes
8	Cursor control keypad	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	General purpose function keys (user defined)	Yes	Yes	Yes	No	No	Yes	INA
10	Edit keys	INA	Yes	Yes	Yes	Yes	Yes	Yes
11	TTY keyboard	INA	INA	No	No	No	No	Yes
12	Key modes	INA	INA	INA	INA	INA	INA	INA
13	Detachable keyboard	Yes	No	Yes	No	Yes	Yes	No
14	Repeat on keys	INA	Yes	INA	INA	Yes	Yes	INA
15	N key rollover	INA	INA	Yes	INA	INA	Yes	INA
16	Keylock switch	INA	INA	INA	INA	INA	INA	Yes
17	Lighted keys	Yes	INA	Yes	INA	Yes	INA	INA
	Display Capability							
18	Non glare screen	Yes	Yes	Yes	Yes	Yes	INA	INA
19	Character set	112	128 ASCII	127 ASCII	96 ASCII	128 ASCII	64 upper case Roman	96 ASCII
20	Tilt screen	No	No	Yes	No	No	No	No
21	Swivel screen	No	No	Yes	No	No	No	No
22	Programmable brightness	Yes	Yes	Yes	Yes	Yes	INA	Yes
23	No. of levels	Two	Two	Two	Two	Two	INA	Two
24	Number of lines	24	24	24	24	24	24	24
25	Characters per line	80	80	80	80	80	80	80
26	Reverse video (programmable)	Yes	Yes	INA	INA	INA	Yes	Yes
27	Blinking (programmable)	Yes	Yes	Yes	INA	Yes	INA	Yes
28	Screen size	14" diagonal	12" diagonal	5 3/4" x 10 1/4"	12" diagonal	12" diagonal	5" x 10"	12" diagonal
29	Non display field for security	INA	Yes	INA	INA	Yes	INA	INA
30	Color display capability	INA	None	INA	None	None	None	None
31	Cursor							
32	control (key, program or both)	Key	Key and program	Key	Key and program	Key and program	Key	Key
33	type (blinking, underline, reverse video, etc.)	INA	Reverse image block	reverse video	block	INA	Blinking underline	INA
34	addressable	INA	Yes	Yes	Yes	Yes	INA	Yes
35	Dot Matrix for characters (8 x 10, 10 x 16, etc.)	13 x 9	9 x 12	7 x 11	5 x 7	5 x 9	7 x 9	7 x 9
36	Status displays (lights or line on CRT)	INA	CRT screen on command and lights	Lights	INA	Lights and CRT	INA	INA
37	Flicker free							
38	refresh screen data rate	INA	Powerline frequency	60 frames/second	60 Hertz	60 fields/second	50 Hertz	INA
39	phosphor type (e.g. P-4)	INA	P-4	INA	INA	P-4	P-4	INA
40	Memory size for display	INA	INA	1920 characters standard up to 5760 optional	INA	INA	INA	INA
	Compose and Edit Features							
41	Erase to end of line	INA	INA	Yes	Yes	INA	INA	INA
42	Erase to end of page	INA	INA	Yes	Yes	Yes	INA	INA
43	Character delete	INA	Yes	Yes	INA	Yes	Yes	Yes
44	Line delete	INA	Yes	Yes	Yes	Yes	Yes	Yes
45	Clear screen	INA	Yes	Yes	Yes	INA	Yes	Yes
46	Character overwrite	INA	INA	INA	INA	INA	INA	Yes
47	Character insert	INA	Yes	Yes	INA	Yes	Yes	Yes
48	Line insert	INA	Yes	Yes	INA	Yes	Yes	Yes
49	Backspace	INA	INA	No	INA	INA	Yes	INA
50	Forward tab	INA	Yes	Yes	Yes	Yes	Yes	INA
51	Backward tab	INA	Yes	No	INA	Yes	INA	INA
52	Adjust space and line automatically when characters, words, or sentences are added or deleted. (word wrap)	INA	INA	Yes	INA	INA	INA	INA
53	Automatically change paging when additions or deletions are made	INA	INA	INA	INA	INA	INA	INA
54	Clear unprotected data	INA	Yes	INA	INA	INA	INA	INA
55	Scroll up or down	INA	Scroll up	Up or down	INA	INA	INA	Up or down
56	Audible alarm for end of line	INA	INA	INA	INA	INA	INA	INA
57	Audible alarm for end of page	INA	INA	INA	INA	INA	INA	INA
58	Automatic paging	INA	INA	INA	INA	INA	INA	INA
59	Protected fields (programmable)	INA	Yes	Yes	Yes	Yes	INA	Yes
60	Cursor control from keyboard	INA	Yes	Yes	Yes	Yes	Yes	Yes
61	Line number display	INA	INA	INA	INA	INA	INA	INA
62	Column number display	INA	INA	INA	INA	INA	INA	INA
63	Word search for delete or replace	INA	INA	INA	INA	INA	INA	INA
64	Next page	INA	INA	INA	INA	INA	Yes	INA
65	Previous page	INA	INA	INA	INA	INA	Yes	INA
66	First page	INA	INA	INA	INA	INA	INA	INA
	Communication Interface and Control							
67	Type interface	INA	RS-232-C	INA	RS-232-C	RS-232-C; 20ma current loop optional MIL-STD-188C MIL-STD-188C-100	RS-232 MIL-STD-188C optional MIL-STD-188-100 optional MIL-STD-188-114 optional	RS-232-C 20ma current loop
68	Transmission rates	INA	75, 110, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Baud	110 to 2400 Baud	75 to 19,200 bps, switch selectable	110, 150, 300, 600, 1200, 2400, 4800, 9600 Baud	110, 150, 300, 1200, 2400, 4800, 9600 Baud	110 to 9600 bits/second
69	Transmission modes							
70	character at a time	INA	INA	Yes	Yes	Yes	INA	Yes
71	line at a time	INA	Yes	Yes	Optional	Yes	INA	Yes
72	full screen at a time	INA	Yes	Yes	Optional	Yes	INA	Yes
73	partial screen at a time	INA	INA	INA	INA	Yes	INA	INA
74	multiple pages at a time	INA	INA	INA	INA	INA	INA	Yes
75	polling	INA	INA	Optional	INA	Optional	INA	Yes
76	**Military Specifications**	INA	INA	INA	INA	INA	MIL-STD-188C MIL-STD-188-100 MIL-STD-188-114 NACSEM 5100	INA

43	44	45	46	47	48	49	50	51	52
	TEC Incorporated	Tektronix	Research Inc. Teleray Div.	Teletype Corp.	Texas Instruments	Texas Instruments	Tymes Incorporated	Wang Laboratories Inc.	[illegible]
(includes one floppy disc drive)	Model 78	4051	4041	4025 50F0	911	914A	Plus 78 Model 8752 with 8634 keyboard	PCS + Option 60A disk drive included	[illegible]
	INA	$7500 to $8600	INA	$3560	INA	INA	INA	INA	INA
memory to 64K bytes		Graphics		Expandable memory		Memory expansion to 32K bytes			
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Y..
	Yes	Yes	Optional	No	Yes	Yes	Yes	Yes	Y..
	INA	No	Optional	Yes	Yes	Yes	Yes	INA	Y..
	Yes	Yes	Optional	No	Yes	INA	Yes	Yes	Y..
	Yes	Yes	Optional	Yes	Yes	Yes	Yes	Yes	Y..
	INA	No	INA	INA	INA	INA	INA	INA	N..
	INA	Yes	INA	Yes	INA	Yes	INA	Yes	INA
	Yes	No	Optional	Yes	Yes	INA	Yes	No	Y..
	Yes	Yes	Yes	INA	Yes	Yes	INA	INA	INA
	Yes	INA	INA	INA	Yes	Yes	INA	INA	INA
	INA	INA	INA	INA	INA	Yes	Yes	INA	INA
	INA	INA	No	INA	INA	INA	INA	INA	INA
	Yes	INA	Yes	Yes	INA	INA	Yes	INA	INA
	126 ASCII	128 ASCII	INA	128 ASCII	128 ASCII	INA	96 ASCII	96	128
	Yes	No	No	Yes	No	No	No	No	No
	Yes	No	No	No	No	No	No	No	No
	Yes	INA	Yes	Optional	Yes	Yes	Yes	INA	Yes
	INA	INA	Two	Two	Two	Two	Two	INA	Two
	25	35	24	24	24	24	24	24	25
	80	72	80	80	80	80	80	80	80
	Yes	INA	Yes	Yes	INA	INA	INA	INA	Yes
	Yes	INA	Yes	INA	Yes	Yes	Yes	INA	Yes
	12" diagonal	8" x 6"	12" diagonal	13" diagonal	12" diagonal	14" diagonal	15" diagonal	INA	15" diag..
	Yes	INA	INA	INA	INA	INA	Yes	INA	INA
	None	None	None	None	None	Green phosphor	White, green optional	None	None
	INA	INA	Key and program	Key	Key	Key and program	Key and program	Key and program	Key
	Blinking underline, blinking block	INA	INA	Reverse video	Blinking	Underline	Blink or non blink	INA	INA
	INA	INA	Yes	INA	INA	Yes	Yes	INA	INA
	8 x 10	INA	INA	7 x 9	5 x 7	7 x 9	5 x 7	INA	10 x 8
	CRT	INA	Lights	INA	Lights	Line on CRT	CRT for self tests	INA	INA
	INA	INA	INA	60 times/second	50 or 60 times/second	INA	60 Hertz	INA	60 fields/..
	P4	INA	INA	INA	INA	INA	INA	INA	P4
	Two pages	INA	3840 characters, 11360 characters optional	72 lines, 80 characters per line	INA	INA	2K to 4K	INA	INA
	Yes	INA	Yes	INA	INA	INA	INA	INA	INA
	Yes	INA	Yes	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes	INA
	Yes	INA	Yes	Yes	INA	INA	INA	Yes	INA
	INA	INA	Yes	Yes	INA	Yes	Yes	Yes	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes	INA
	Yes	Yes	Yes	Yes	INA	INA	INA	Yes	INA
	INA	Yes	INA	INA	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	INA	Yes
	Yes	Yes	Yes	INA	INA	Yes	Yes	INA	Yes
	INA	Yes	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	Yes	INA	INA	INA	INA	INA
	INA	INA	INA	Up or down	INA	INA	INA	INA	up or down
	INA	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	Yes	Yes	Yes	Yes	Yes	INA	INA
	INA	INA	Yes	Yes	Yes	Yes	Yes	INA	Yes
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	INA	INA	INA
	INA	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
..t loop	RS-232-C Current loop, TTL	IEEE 488-1975 GPIB RS-232 option 01	RS-232-C current loop optional	RS-232 20/60ma current loop	INA	RS-232-C optional	INA	INA	RS-232 C RS-422/4..
..bits/second	50 to 9600 Baud	110 to 2400 Baud	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800 bits per second	INA	Selectable to 9600 Baud	Selectable from 300 to 19,200 bps		Up to 19.2..
	Yes	INA	Yes	Yes	INA	INA	INA	INA	INA
	Yes	INA	Yes	INA	INA	INA	INA	INA	INA
	Yes	INA	Yes	INA	INA	INA	INA	INA	INA
	Yes	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	INA	Yes	INA	INA	INA	INA	INA	INA
	Yes	INA	Optional	INA	INA	Yes	Yes	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA

45	46	47	48	49	50	51	52	53
onix	Research Inc Teleray Div	Teletype Corp	Texas Instruments	Texas Instruments	Trivex Incorporated	Wang Laboratories, Inc	Zentec	Zentec
	4041	4025 50F0	911	914A	Plus 70 Model 8752 with 8634 keyboard	PCS II Option 60A disk drive included	ZMS 70 dual disk drive included	ZMS 50
to $8600	INA	$3560	INA	INA	INA	INA	INA	INA
ics		Expandable memory		Memory expansion to 32K bytes				
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Optional	No	Yes	Yes	Yes	Yes	Yes	No
	Optional	Yes	Yes	Yes	Yes	INA	Yes	Yes
	Optional	No	Yes	INA	Yes	Yes	Yes	Yes
	Optional	Yes	Yes	Yes	Yes	Yes	Yes	No
	INA	INA	INA	INA	INA	INA	No	No
	INA	Yes	INA	Yes	INA	Yes	INA	Yes function keys
	Optional	Yes	Yes	INA	Yes	No	Yes	No
	Yes	INA	Yes	Yes	INA	INA	INA	INA
	INA	INA	Yes	Yes	INA	INA	INA	INA
	INA	INA	INA	Yes	Yes	INA	INA	INA
	No	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	INA	INA	Yes	INA	INA	INA
SCII	INA	128 ASCII	128 ASCII	INA	96 ASCII	96	128	96 ASCII
	No	Yes	No	No	No	No	No	No
	No	No	No	No	No	No	No	No
	Yes	Optional	Yes	Yes	Yes	INA	Yes	Yes
	Two	Two	Two	Two	Two	INA	Two	Two
	24	24	24	24	24	24	25	25
	80	80	80	80	80	80	80	80
	Yes	Yes	INA	INA	INA	INA	Yes	Yes
	Yes	INA	Yes	Yes	Yes	INA	Yes	Yes
	12" diagonal	13" diagonal	12" diagonal	14" diagonal	15" diagonal	INA	15" diagonal	12" diagonal
	INA	INA	INA	INA	Yes	INA	INA	INA
	None	None	None	Green phosphor	White, green optional	None	None	None
	Key and program	Key	Key	Key and program	Key and program	Key and program	Key	Key
	INA	Reverse video	Blinking	Underline	Blink or non blink	INA	INA	INA
	Yes	INA	INA	Yes	Yes	INA	INA	INA
	INA	7 x 9	5 x 7	7 x 9	5 x 7	INA	10 x 8	7 x 9
	Lights	INA	Lights	Line on CRT	CRT for self tests	INA	INA	25th line on CRT
	INA	60 times/second	50 or 60 times/second	INA	60 Hertz	INA	60 fields/second	60 fields/second
	INA	INA	INA	INA	INA	INA	P4	P4
	3840 characters, 11360 characters optional	72 lines, 80 characters per line	INA	INA	2K to 4K	INA	INA	4K to 16K (46 lines to 199 lines)
	Yes	INA	INA	INA	INA	INA	INA	Yes
	Yes	INA	INA	INA	INA	INA	INA	Yes
	Yes	Yes	Yes	INA	Yes	Yes	INA	Yes
	Yes	Yes	INA	INA	INA	Yes	INA	Yes
	Yes	Yes	INA	Yes	Yes	Yes	INA	Yes
	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	INA	Yes	Yes	INA	INA
	Yes	Yes	INA	INA	INA	Yes	INA	Yes
	INA	INA	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
	Yes	INA	INA	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	INA	INA	INA	INA	Yes
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	Up or down	INA	INA	INA	INA	up or down	up or down
	Yes	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	Yes	Yes	INA	INA	Yes
	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
88-1975 GP1B option 01	RS-232-C current loop optional	RS-232 20/60ma current loop	INA	RS-232 C optional	INA	INA	RS-232-C RS-422/449 optional	RS-232-C RS-422/449 optional
2400 Baud	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800 bits per second	INA	Selectable to 9600 Baud	Selectable from 300 to 19,200 bps		Up to 19.2 Kbps	110, 150, 300, 1200, 1800, 2400, 4800, 9600 BPS selectable
	Yes	Yes	INA	INA	INA	INA	INA	Yes
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Optional	INA	INA	Yes	Yes	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA

	control key, program or both	Key	Key and program	Key	Key and program	Key and program	Key	Key
33	type: blinking, underline, reverse video, etc.	INA	Reverse image block	reverse video	block	INA	Blinking underline	INA
34	addressable	INA	Yes	Yes	Yes	Yes	INA	Yes
35	Dot Matrix for characters (8 x 10, 10 x 16, etc.)	13 x 9	9 x 12	7 x 11	5 x 7	5 x 9	7 x 9	7 x 9
36	Status displays (lights or line on CRT	INA	CRT screen on command and lights	Lights	INA	Lights and CRT	INA	INA
37	Flicker free							
38	refresh screen data rate	INA	Powerline frequency	60 frames second	60 Hertz	60 fields second	60 Hertz	INA
39	phosphor type (e.g. P-4)	INA	P-4	INA	INA	P-4	P-4	INA
40	Memory size for display	INA	INA	1920 characters standard up to 5760 optional	INA	INA	INA	INA
	Compose and Edit Features							
41	Erase to end of line	INA	INA	Yes	Yes	INA	INA	INA
42	Erase to end of page	INA	INA	INA	Yes	Yes	INA	INA
43	Character delete	INA	Yes	Yes	INA	Yes	Yes	Yes
44	Line delete	INA	Yes	Yes	Yes	Yes	Yes	Yes
45	Clear screen	INA	Yes	Yes	Yes	INA	Yes	Yes
46	Character overwrite	INA	INA	INA	INA	INA	INA	Yes
47	Character insert	INA	Yes	Yes	INA	Yes	Yes	Yes
48	Line insert	INA	Yes	Yes	INA	Yes	Yes	Yes
49	Backspace	INA	INA	No	INA	INA	Yes	INA
50	Forward tab	INA	Yes	Yes	Yes	Yes	Yes	INA
51	Backward tab	INA	Yes	No	INA	Yes	INA	INA
52	Adjust space and line automatically when characters, words, or sentences are added or deleted (word wrap)	INA	INA	Yes	INA	INA	INA	INA
53	Automatically change paging when additions or deletions are made	INA	INA	INA	INA	INA	INA	INA
54	Clear unprotected data	INA	Yes	INA	INA	INA	INA	INA
55	Scroll up or down	INA	Scroll up	Up or down	INA	INA	INA	Up or down
56	Audible alarm for end of line	INA	INA	INA	INA	INA	INA	INA
57	Audible alarm for end of page	INA	INA	INA	INA	INA	INA	INA
58	Automatic paging	INA	INA	INA	INA	INA	INA	INA
59	Protected fields (programmable)	INA	Yes	Yes	Yes	Yes	INA	Yes
60	Cursor control from keyboard	INA	Yes	Yes	Yes	Yes	Yes	Yes
61	Line number display	INA	INA	INA	INA	INA	INA	INA
62	Column number display	INA	INA	INA	INA	INA	INA	INA
63	Word search for delete or replace	INA	INA	INA	INA	INA	INA	INA
64	Next page	INA	INA	INA	INA	INA	Yes	INA
65	Previous page	INA	INA	INA	INA	INA	Yes	INA
66	First page	INA	INA	INA	INA	INA	INA	INA
	Communication Interface and Control							
67	Type interface	INA	RS-232-C	INA	RS 232 C	RS 232 C 20ma current loop optional MIL STD 188C MIL STD 188C 100	RS 232 MIL STD 188C optional MIL STD 188 100 optional MIL STD 188 114 optional	RS 232 C 20ma current loop
68	Transmission rates	INA	75, 110, 200, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 Baud	110 to 2400 Baud	75 to 19,200 bps, switch selectable	110, 150, 300, 600, 1200, 2400, 4800, 9600 Baud	110, 150, 300, 1200, 2400, 4800, 9600 Baud	110 to 9600 bits second
69	Transmission modes							
70	character at a time	INA	INA	Yes	Yes	Yes	INA	Yes
71	line at a time	INA	Yes	Yes	Optional	Yes	INA	Yes
72	full screen at a time	INA	Yes	Yes	Optional	Yes	INA	Yes
73	partial screen at a time	INA	INA	INA	INA	Yes	INA	INA
74	multiple pages at a time	INA	INA	INA	INA	INA	INA	Yes
75	polling	INA	INA	Optional	INA	Optional	INA	Yes
76	**Military Specifications**	INA	INA	INA	INA	INA	MIL-STD 188C MIL STD 188 100 MIL STD 188 114 NACSEM 5100	INA
	Physical Dimensions							
77	Depth	24.5"	23.5"	28.5"	20.5"	24"	28½"	25"
78	Width	22.5"	21.5"	18"	18"	20½"	18 5/8"	24"
79	Height	16.6"	19.5"	23" max.	13"	12½"	16" high	13"
80	Weight	68 lbs.	50 lbs.	INA	45 lbs.	75 lbs.	58½ lbs.	60 lbs.
	Power Requirements							
81	Voltage (ac)	120 | 220	115V ±10%	INA	115V ±10%	115VAC	115V -10% 23%	120V
82	Current	INA | INA	INA	INA	INA	INA	INA	2 Amps
83	Frequency	60 Hertz | 50 Hertz	60 Hertz	INA	60 Hertz	60 Hertz	60 Hertz + .02%	60 Hertz
84	Phases	INA | INA	INA	INA	INA	INA	INA	INA
85	Watts	170 | 170	INA	INA	INA	INA	85 to 140	INA
	Environmental							
86	Operating							
87	temperature	INA	0° to 45°C	INA	+5° to 40°C	INA	0°C to 55°C	INA
88	humidity (non-condensing)	INA	0 to 80%	INA	5% to 90%	INA	5% to 95%	INA
89	Storage and shipping							
90	temperature	INA	INA	INA	INA	INA	-40° to +75°C	INA
91	humidity (non-condensing)	INA	INA	INA	INA	INA	INA	INA
92	altitude	INA	INA	INA	INA	INA	Up to 25,000 ft.	INA
93	Equipment cooling method (convection or forced air)	INA	INA	INA	INA	INA	INA	INA

INA – INFORMATION NOT AVAILABLE N/A – NOT APPLICABLE

4

1

	Key	NA	INA	Key and program	Key	Key	Key and program	Key and program	Key and program
	INA	Blinking ... blinking block	INA	INA	Reverse video	Blinking	Underline	[illegible]	INA
	Yes	INA	INA	Yes	INA	INA	Yes	Yes	INA
	7 x 9	8 x 10	INA	INA	7 x 9	5 x 7	7 x 9	5 x 7	INA
	INA	CRT	INA	Lights	INA	Lights	Line on CRT	CRT [illegible]	INA
	INA	INA	INA	INA	60 times second	50 or 60 times second	INA	60 Hertz	INA
	INA	P4	INA	INA	INA	INA	INA	NA	INA
	INA	Two pages	INA	3840 characters 11360 characters optional	72 lines 80 characters per line	INA	INA	24 x 48	INA
	INA	Yes	INA	Yes	INA	INA	INA	NA	INA
	INA	Yes	INA	Yes	INA	INA	INA	NA	INA
	Yes	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
	Yes	Yes	INA	Yes	Yes	INA	INA	INA	Yes
	Yes	INA	INA	Yes	Yes	INA	Yes	Yes	Yes
	Yes	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	INA	INA	INA	Yes
	INA	INA	Yes	INA	INA	Yes	Yes	Yes	Yes
	INA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	INA
	INA	Yes	Yes	Yes	INA	INA	Yes	Yes	INA
	INA	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	NA	INA
	INA	INA	INA	INA	Yes	INA	INA	NA	INA
	Up or down	INA	INA	INA	Up or down	INA	INA	NA	INA
	INA	INA	INA	Yes	INA	INA	INA	NA	INA
	INA	INA	INA	INA	INA	INA	INA	NA	INA
	INA	INA	INA	INA	INA	INA	INA	NA	INA
	Yes	Yes	INA	Yes	Yes	Yes	Yes	Yes	INA
	Yes	INA	INA	Yes	Yes	Yes	Yes	Yes	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	INA	INA	Yes	INA	INA	INA	INA	INA
	INA	INA	INA	Yes	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
onal ptional ptional	RS 232 C 20ma current loop	RS 232 C Current loop TTL	IEEE 488 1975 GP18 RS 232 option 01	RS 232 C current loop optional	RS 232 20/60ma current loop	INA	RS 232 C optional	INA	INA
) 2400	110 to 9600 bits/second	50 to 9600 Baud	110 to 2400 Baud	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800 bits per second	INA	Selectable to 9600 Baud	Selectable from 300 to 19,200 bps	
	Yes	Yes	INA	Yes	Yes	INA	INA	INA	INA
	Yes	Yes	INA	Yes	INA	INA	INA	INA	INA
	Yes	Yes	INA	Yes	INA	INA	INA	INA	INA
	INA	Yes	INA	Yes	INA	INA	INA	INA	INA
	Yes	INA	INA	Yes	INA	INA	INA	INA	INA
	Yes	Yes	INA	Optional	INA	INA	Yes	Yes	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	25"	22"	32.5"	21"	25¼"	INA	28"	28.5	20½"
	24"	15.75"	18.3"	15.5"	17"	INA	22"	16	19¾"
	13"	17.25"	13.6"	13.5"	16½"	INA	17"	17.5"	18¾
	60 lbs.	INA	65 lbs.	43 lbs.	110 lbs.	INA	70 lbs.	74 lbs.	62 lbs.
	120V	100, 115 or 230	90 to 132V or 180 to 264V	INA	115V	INA	109 to 126V or 197 to 253V	115/220	115 or 230V ±10%
	2 Amps	INA	INA	INA	INA	INA	INA	INA	INA
	60 Hertz	50/60 Hertz	48-66 Hertz	INA	60 Hertz	INA	60 Hertz ± 0.1%	50/60 Hertz	50 or 60 Hertz ±1 Hertz
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	200 max.	INA	INA	INA	200	200	415
	INA	INA	10°C to 40°C	INA	+40° to 110°F	INA	10°C to 30°C	INA	10°C to 32°C
	INA	INA	INA	INA	2% to 95%	INA	0% to 95%	INA	30% to 70%
	INA	INA	INA	INA	INA	INA	-40°C to +65°C	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA Convection	INA	INA

5

	Key and program	Key	Key	Key and [illegible]	Key and program	Key and program	Key	Key
	INA	Reverse video	Blinking	Underline	Blink or non blink	INA	INA	INA
	Yes	INA	INA	Yes	Yes	INA	INA	INA
	INA	7 x 9	5 x 7	7 x 9	5 x 7	INA	10 x 8	7 x 9
	Lights	INA	Lights	Line on CRT	CRT for self tests	INA	INA	25th line on CRT
	INA	60 times second	50 or 60 times second	INA	60 Hertz	INA	60 fields second	60 fields second
	INA	INA	INA	INA	INA	INA	P4	P4
	3840 characters 11360 characters optional	72 lines 80 characters per line	INA	INA	2K to 4K	INA	INA	4K to 16K 46 lines to 199 lines
	Yes	INA	INA	INA	INA	INA	INA	Yes
	Yes	INA	INA	INA	INA	INA	INA	Yes
	Yes	Yes	Yes	INA	Yes	Yes	INA	Yes
	Yes	Yes	INA	INA	INA	Yes	INA	Yes
	Yes	Yes	INA	Yes	Yes	Yes	INA	Yes
	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	INA	Yes	Yes	INA	INA
	Yes	Yes	INA	INA	INA	Yes	INA	Yes
	INA	INA	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
	Yes	INA	INA	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	INA	INA	INA	INA	Yes
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	INA	INA
	INA	Up or down	INA	INA	INA	INA	up or down	up or down
	Yes	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	Yes	Yes	Yes	Yes	INA	INA	Yes
	Yes	Yes	Yes	Yes	Yes	INA	Yes	Yes
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
975 GP1B on 01	RS 232 C current loop optional	RS 232 20 60ma current loop	INA	RS 232 C optional	INA	INA	RS 232 C RS-422 449 optional	RS 232 C RS 422 449 optional
Baud	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 7200, 9600, 19,200 Baud	110, 150, 300, 600, 1200, 2400, 4800 bits per second	INA	Selectable to 9600 Baud	Selectable from 300 to 19,200 bps		Up to 19.2 Kbps	110 150 300 1200 1800 2400 4800 9600 BPS selectable
	Yes	Yes	INA	INA	INA	INA	INA	Yes
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Yes	INA	INA	INA	INA	INA	INA	INA
	Optional	INA	INA	Yes	Yes	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	21"	25¼"	INA	28"	28.5"	20½"	30"	22"
	15.5"	17"	INA	22"	16"	19¾"	21"	18"
	13.5"	16½"	INA	17"	17.5"	18¾"	16"	13"
	43 lbs.	110 lbs.	INA	70 lbs.	74 lbs.	62 lbs.	80 lbs.	55 lbs.
or 100 to 264V	INA	115V	INA	109 to 126V or 197 to 253V	115/220	115 or 230V ±10%	120	120V
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	60 Hertz	INA	60 Hertz ±0.1%	50 60 Hertz	50 or 60 Hertz ±1 Hertz	60 Hertz	60 Hertz
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	200	200	415	INA	INA
C	INA	+40° to 110 F	INA	10 C to 30 C	INA	10 C to 32 C	5 C to 35 C	5 C to 35 C
	INA	2% to 95%	INA	0% to 95%	INA	30% to 70%	20% to 80%	20% to 80%
	INA	INA	INA	-40 C to +65 C	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA	INA	INA	INA	INA	INA
				Convection				

5

6

APPENDIX C
MAGNETIC DEVICE CHARACTERISTICS AND EQUIPMENTS

#	Item Number	01	02	03	04	05	06	07
2	Magnetic Type Drive	Floppy Disk	Tape Cassette	Floppy Disk	Floppy Disk	Floppy Disk	Floppy Disk	Floppy Disk
3	Manufacturer	American Microsystem, Inc	Interdyne	Business System Technology, Inc	Data Terminals and Communication[illegible]	Perkin Elmer Data Systems, Wangco	Perkin Elmer Data Systems, Wangco	Digital Equipment Corp
4	Model Number	MDC 120	3801	BST 41	DTC M[illegible]	Model 82	Model 8[illegible] Dual Floppy	RX 78
5	Cost Range	$4200	$1950	INA	INA	INA	INA	INA
	Drives per Unit							
6	Storage capacity per drive	256,256 bytes	540,000 bytes	242,944 characters	300K characters	124.7K bytes, double density optional double sided optional	256,256 bytes	256,256 8 bit bytes [illegible] 128,1[illegible] 12 bit words
7	Data format on medium	IBM 3740	ANSI phase encoded	IBM 3741 42	77 tracks x 32 sectors x 128 characters	Modified IBM type	Track format is IBM 3740 compatible	Industry standard
8	Number of drives	two	one	One (two optional)	Two (up to [illegible] optional)	One	Two	Two
9	Drive speed	INA	12 ips read write, 40 ips search 120 ips forward or backward	360 RPM	INA	INA	INA	360 RPM
10	Data density on medium	INA	800 bpi	3268 BPI	INA	INA	3200 BPI inside track, 48 tracks per inch	INA
	Operational Characteristics							
11	Maximum access time for data	INA	INA	INA	260 milliseconds	INA	INA	INA
12	Average access time for data	INA	INA	INA	200 milliseconds	370 milliseconds	INA	483 milliseconds
13	Transfer rates	INA	9600 BPS	Reads 3000 Records min Writes 2000 records min	INA	125,000 bps FM encoding 250,000 bps double density	INA	10K bytes second byte mode 5K words second 12 bit mode
14	Error rate	INA	1 to 10 hard	INA	INA	1 in 10 hard, 1 in 10 soft	INA	INA
15	Protocol for drive control and data transfer	FDOS II	ASCII Remote 40 ips search	INA	INA	INA	INA	INA
16	Self Test Mode	Yes	No	INA	INA	INA	INA	INA
	Operator Controls and Indicators							
17	Power on off switch	Yes	Yes	No	Yes	INA	Yes	INA
18	Operating mode switch	No	Yes	Yes	Yes	INA	INA	INA
19	Keylock switch (controls power or operating controls)	No	No	No	INA	INA	INA	INA
	Size of Magnetic Medium to be used by Magnetic Device		INA					
20	Diameter	5 1/4" Diskette		5 1/4"	5 1/4" diskette	5.25" diskette	5 1/4" diskette	8"
21	Thickness	(N/A)		N/A	N/A	N/A N/A	N/A N/A	N/A N/A
22	Length	(N/A)		N/A	N/A	N/A	N/A	N/A
23	Width	(N/A)		N/A	N/A			
	Data Input/Output Interface and Control							
	Type interface							
24	RS 232C	Yes	Yes	INA	RS 232	INA	INA	INA
25	NTDS slow	INA	No					
26	NTDS fast	INA	No					
27	ANEW	INA	No					
28	MIL STD 188 C	INA	No					
29	MIL STD 188-114	INA	No					
30	MIL STD 188-100	INA	No					
31	Current Loop	INA	Yes					
32	Baud rate(s)	INA	110; 300; 600; 1200; 2400; 4800; 9600; 19200;		110, 300, 1200, 2400, 4800, 9600 Baud, switch or program selectable			
33	Military Specification Conformance	INA	INA	INA	INA	INA	INA	INA
	Physical Dimensions	INA					INA	INA
34	Length		13"	INA	23.5"	7.95"		
35	Width		11-1/2"	INA	17.25"	5.75"		
36	Height		10"	INA	11"	3.25"		
37	Weight		20 lbs.	98 lbs.	71.75 lbs	INA		
	Power Requirements	INA					INA	INA
38	Voltage (ac)		115 ± 10%	230V	115V ± 10%	INA		
39	Current		INA	2.5 Amps	INA	INA		
40	Frequency		50/60 Hertz	INA	60 Hertz	INA		
41	Phase		One	INA	INA	INA		
42	Watts		125	600	INA	15		
	Environmental	INA				INA	INA	INA
43	Operating							
44	ambient temperature		0 to 50 deg C	10° to 35° C	90° F maximum at			
45	humidity (non-condensing)		20 to 95%	INA	80%			
46	Storage and shipping							
47	ambient temperature		INA	INA	INA			
48	humidity (non-condensing)		INA	INA	INA			
49	altitude		INA	INA	10,000 ft.			

N/A - NOT APPLICABLE   INA - INFORMATION NOT AVAILABLE

06	07	08	09	10	11	12	13
Floppy Disk	Floppy Disk	[illegible]	[illegible]	[illegible]	Tape Cassette	Disk	Tape Cartridge
Perkin Elmer Data Systems Wangco	Digital Equipment Corp.	[illegible]	[illegible]	[illegible]	[illegible]	Perkin Elmer Data Systems Wangco	National Microcomputer [illegible]
Model 87 Dual Floppy	RX 78	[illegible]	[illegible]	[illegible] Model 6300	154-20 Dual Drive	Super [illegible]	Series 232 Data Station
NA	NA	NA	NA	NA	NA	INA	$2795
256/256 bytes	256/256 8 bit bytes or 128/128 12 bit words	[illegible]	[illegible]	[illegible]	288,000 characters	100 megabytes per disk, 20 megabytes	[illegible] bytes
Track format is IBM 3740 compatible	Industry standard	[illegible]	[illegible]	Modified Frequency Modulation	Phase encoding	NA	[illegible]
Two	Two	One		Two	Two	One	Two
INA	380 RPM	2964 RPM	[illegible] RPM, 2400 RPM	30 ips read/write, 90 ips search, rewind and fast fwd	7.5 ips read/write [illegible], 48 ips rewind	INA	30 ips read/write and search, 60 ips rewind
3200 BPI [illegible] track, 48 tracks per inch	INA	5636 bits/inch [illegible]	NA	6400 bits/inch	780 bits/inch	4400 bits/inch	800 bits/inch
					INA		NA
INA	INA	67 milliseconds [illegible]	NA	INA		NA	
NA	483 milliseconds	42 milliseconds	[illegible] seconds	NA		33 milliseconds	
INA	10K bytes/second (8 bit mode), 5K words/second (12 bit mode)	7.06 MHz	200K bits/sec (1500 RPM), 320K bits/sec (2400 RPM)	192,000 bits per second		NA	
INA	INA	1 in 10[illegible] bits [illegible]; 1 in 10[illegible] bits recoverable	1 in 10[illegible] unrecoverable; 1 in 10[illegible] recoverable	1 in 10[illegible]		INA	
INA	INA	INA	NA	INA		INA	
INA	INA	INA	NA	INA	INA	INA	[illegible]
			NA			INA	
Yes	INA	INA		Yes	Yes		Yes
INA	INA	INA		Yes	Yes		Yes
INA	INA	INA		INA	INA		NA
						INA	
5 1/4" diskette	8"	INA	14"	INA	INA		INA
NA	NA	INA	INA	ANSI Std. Data Cartridge	Computer grade Philips cassette specified by ANSI X3B1 638		3M type DC 300A Data Cartridge
NA	NA	INA	NA				
NA	NA	INA	NA				
INA	INA	INA	INA	INA	RS 232 C	INA	RS 232 C
					1200 Baud		50 to 19.2K Baud
INA	INA	INA	INA	INA	INA	INA	INA
INA	INA	28	27	13	20.9	22	10
		19	19	19"	19.6"	19	17
		7	8.75	7	7.7"	7 3/4	5 1/4
		100 lbs	120 lbs	40 lbs	41 lbs	INA	22 lbs
INA	INA	100/115	115/220 ±10%	115/220	120 / 220/240	INA	115/230
		20 Amp surge	INA	INA	1 Amp / 0.5 Amp	INA	INA
		60 Hertz	59.5 to 60.5 Hertz or 49.5 to 50.5 Hertz	60 Hertz (50 Hz optional)	60 Hertz / 50 Hertz	INA	50/60 Hertz
		One	INA	One	INA / INA	INA	INA
		350 (max)	INA	150	INA / INA	400	INA
INA	INA					INA	
		15 to 41 C	12 to 40 C	5 C to 45 C	10 C to 40 C (forced air)		0 C to 50 C
		10% to 80%	10% to 80%	10% to 80%	20% to 80%		20% to 80%
		INA	INA	-26°C to +60°C	INA		INA
		INA	INA	5% to 95%	INA		INA
		INA	INA	40,000 feet	INA		INA

AD-A085 306 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CA F/G 17/2
NAVAL OUTGOING MESSAGE PROCESSING, A STUDY OF MESSAGE GENERATIO--ETC(U)
DEC 79
UNCLASSIFIED NOSC/TR-475 NL

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APPENDIX D

TYPEWRITER TERMINAL CHARACTERISTICS AND EQUIPMENTS

1	Item Number	01	02	03	04	05
2	Manufacturer	A. B. Dick Co.	Agile	Burroughs, Redactron	E-Systems, ECI Division	IBM, Office Products D
3	Model	MAGNA I	Model A1	Redactor 1, Series Q	T-1148	Memory 100 Typewr Model 5661
4	Cost Range	$9532.50	INA	INA	INA	$4655
	Keyboard	INA				
5	Numeric cluster and number of keys		Yes	INA	No	No
6	General purpose function keys		Yes	INA	No	No
7	Repeat function		Yes	Yes	Yes	Yes
8	N-key rollover		Yes	Yes	INA	INA
9	Index key		INA	Yes	No	Yes
10	Security lock key		INA	INA	INA	Optional
	Print and Print Mechanism					
11	Line printer	INA	No	INA	INA	No
12	Dot matrix printer	INA	No	No	Yes	No
13	Ink jet printer	INA	No	No	No	No
14	Daisywheel printer	INA	Yes	Yes	No	No
15	Impact printing	INA	Yes	Yes	Yes	Yes
16	Speed (characters per second)	INA (500 + words/minute)	30 (45 and 55 optional)	40	120	15.5 cps
17	Number of printable characters	94	96	96	INA	86
18	Programmable impact of print hammer	INA	INA	INA	INA	No
19	Operator changeable type style	INA	Yes	Yes	No	Yes
20	OCR A font available	INA	INA	INA	Optional	Yes
21	OCR B font available	INA	INA	INA	INA	Yes
22	Pitch	10 and 12	10 or 12	10.28 and 12	10	10 and 12
23	Lines per inch	INA	6 or 8	6	6	INA
24	Line length (characters per line per pitch)	INA	132 (10 pitch); 158 (12 pitch)	132 (10.28 pitch); 158 (12 pitch)	80	125 (10 pitch); 150 (12
25	Maximum width of paper	INA	about 14"	15"	INA	15-1/2"
26	Data buffer for print	INA	256 characters	INA	16,000 characters	4000 characters
27	End of ribbon shut off	Yes	INA	INA	INA	Yes
	Communication Electrical Interface	INA				
28	Baud rate		600 Baud option	INA	50, 75, 100, 110, 150, 200, 300, 600, 1200, 2400 selectable	INA
29	Type		RS-232	INA	CCITT V28 (±6V low level) current loop (60V, 60 ma) High level (±80V, 20 ma)	INA
	Compose and Edit Features					
30	Backspace	INA	INA	Yes	Yes	Yes
31	Audible alarm for end of line	INA	INA	INA	INA	INA
32	Audible alarm for end of page	INA	INA	INA	INA	INA
33	Repeat key for hyphen	INA	Yes	INA	INA	Yes
34	Size of memory for typed message	8000 characters	INA	INA	INA	100 pages storage
35	Automatic carrier return	Yes	INA	INA	INA	INA
36	Character insert	INA	INA	INA	Yes	Yes
37	Correcting ribbon	INA	INA	INA	INA	Yes
38	Line insert	INA	INA	INA	Yes	Yes
39	Word wrap	Yes	INA	INA	INA	INA
40	Word search	Yes	INA	Optional	INA	INA
41	Character delete	INA	INA	INA	Yes	Yes
42	Line delete	INA	INA	INA	Yes	Yes
43	N-key rollover	INA	Yes	Yes	INA	INA
44	Indicator status lights	INA	Yes	Yes	Yes	Yes
45	Self Test Mode	Yes	INA	INA	Yes	INA
46	Military Specifications Conformance	INA	INA	INA	MIL-E-4158 MIL-E-5400 MIL-E-16400 MIL-STD-461 MIL-STD-462 NACSEM 5100	INA
	Physical Dimensions					
47	Depth	20-1/2"	21"	19-1/2"	23"	18"
48	Width	23-7/8"	23-1/2"	21"	18"	20-3/4"
49	Height	8-1/4"	32"	7-1/4"	9"	7-1/2"
50	Weight	45 lbs.	86 lbs.	55 lbs.	50 lbs.	75 lbs.

N/A - NOT APPLICABLE INA - INFORMATION NOT AVAILABLE

	03	04	05	06	07	08
	Burroughs, Redactron	E-Systems, ECI Division	IBM, Office Products Division	TRANSACTION DATA SYSTEMS, INC.	Perkins-Elmer Data Systems, Terminal Division	Oume
	Redactor 1, Series Q	T-1148	Memory 100 Typewriter. Model 5681	TRANSWRITER (add-on to IBM SELECTRIC)	Carousel 310	Sprint 5 KSR
	INA	INA	$4655.	$2495.	INA	$2480.
				Same as IBM SELECTRIC		
	INA	No	No		Yes	Yes
	INA	No	No		INA	No
	Yes	Yes	Yes		INA	Yes
	Yes	INA	INA		INA	Yes
	Yes	No	Yes		INA	INA
	INA	INA	Optional		INA	INA
				Same as IBM SELECTRIC		
	INA	INA	No		No	No
	No	Yes	No		No	No
	No	No	No		No	No
	Yes	No	No		No	Yes
	Yes	Yes	Yes		Yes	Yes
	40	120	15.5 cps		40 cps peak	45 cps or 55 cps
	96	INA	86		96 ASCII	96
	INA	INA	No		INA	INA
	Yes	No	Yes		Yes	Yes
	INA	Optional	Yes		Yes	Yes
	INA	INA	Yes		INA	INA
	10.28 and 12	10	10 and 12		10 and 12.5	10 or 12 or 15
	6	6	INA		6 (8 optional)	6
pitch)	132 (10.28 pitch); 158 (12 pitch)	80	125 (10 pitch); 150 (12 pitch)		128	132 (10 pitch); 158 (12 pitch)
	15"	INA	15-1/2"		15-1/2"	14.65"
	INA	16,000 characters	4000 characters		INA	17 characters
	INA	INA	Yes		INA	Yes
	INA	50, 75, 100, 110, 150, 200, 300, 600, 1200, 2400 selectable	INA	INA	110, 150, 300 Baud std., 1200 Baud optional	110, 150, 300, 600, 1200 Baud
	INA	CCITT V28 (±6V low level) current loop (60V, 60 ma) High level (±80V, 20 ma)	INA	INA	RS-232-C	RS-232-C or 20 ma current loop
	Yes	Yes	Yes	Same as IBM SELECTRIC	INA	Yes
	INA	INA	INA			INA
	INA	INA	INA			INA
	INA	INA	Yes			INA
	INA	INA	100 pages storage	20 pages per tape cassette		INA
	INA	INA	INA	Yes		INA
	INA	Yes	Yes	Yes		INA
	INA	INA	Yes	IBM SELECTRIC Capability		INA
	INA	Yes	Yes	Yes		INA
	INA	INA	INA	INA		INA
	Optional	INA	INA	INA		INA
	INA	Yes	Yes	Yes		INA
	INA	Yes	Yes	Yes		INA
	Yes	INA	INA	IBM SELECTRIC Capability		Yes
	Yes	Yes	Yes	IBM SELECTRIC Capability		Yes
	INA	Yes	INA	INA	Yes	Yes
	INA	MIL-E-4158 MIL-E-5400 MIL-E-16400 MIL-STD-461 MIL-STD-462 NACSEM 5100	INA	INA	INA	INA
	19-1/2"	23"	18"	Adds several inches to depth of IBM SELECTRIC	24"	25.3"
	21"	18"	26-3/4"		28"	23.5"
	7-1/4"	9"	7-1/2"		9"	7.625[4]
	65 lbs.	60 lbs.	75 lbs.	INA	INA	40.5 lbs.

PLICABLE INA - INFORMATION NOT AVAILABLE

APPENDIX E
PRINTER CHARACTERISTICS AND EQUIPMENTS

1	Item number	01	02	03	04	05	06	
2	Manufacturer	AGILE	Data General Corp.	Data 100 Corp.	Racal-Milgo (ICC)	Perkin-Elmer Data Systems, *Terminal Division*	Teletype Corp	Qume
3	Model number	A1R (Qume mechanism)	6043	4430 Whisper Quiet	40 + 20C	Carousel 310	4010-8F0D	Sprint 5
4	Cost Range	INA	INA	INA	INA	INA	$8205	$2140
	Print style							
5	*Fully-formed characters*	Yes	No	Yes	INA	Yes	Yes	Yes
6	Dot matrix	No	5 x 7	INA	INA	No	No	No
7	OCR A font available	INA	INA	Yes	INA	Yes	INA	INA
8	OCR B font available	INA	INA	Yes	INA	INA	INA	INA
9	Operator changeable	Yes	INA	INA	INA	Yes	INA	Yes
10	Variable pitch	Yes	No	INA	No	10 or 12.5	No	10, 12 o
	Print mechanism							
11	Ink jet printer	No	INA	No	INA	No	No	No
12	Daisy wheel printer	Yes	No	No	INA	No	No	Yes
13	*Impact printing*	Yes	INA	INA	Yes	Yes	Yes	Yes
14	Characters printed per second	30, 45 or 55	30	(300 lines per minute)	(180 lines per minute)	40	3.7 lines/sec. (80 characters/line)	45 (55 op
15	Programmable impact of print hammer	INA	INA	INA	INA	INA	INA	Yes
16	Lines printed per inch	6 or 8	6	6	6	6 or 8	6 or 3	6
17	End of ribbon indicator or control	INA	INA	INA	No	INA	INA	Yes
18	Vertical line space	INA	INA	INA	INA	INA	INA	INA
	Paper Handling							
19	Maximum width of paper	14-7/8"	15"	16"	12-27/32"	15-1/2"	8-1/2"	14.65"
20	Friction feed	Yes	INA	No	Yes	Yes	Yes	Yes
21	Pin feed	Optional	INA	Yes	No	Optional	Optional	Yes
22	Vertical slew rate	INA	INA	INA	INA	INA	INA	5 inches s
23	Paper thickness	INA	INA	INA	INA	INA	INA	INA
	Programmable controls		INA	INA	INA		INA	
24	Horizontal tab to column number	Yes				INA		Yes
25	Vertical tab to line number	Yes				INA		Yes
26	Relative horizontal increment moves	1/120"				1/100" increments		1/120"
27	Relative vertical increment moves	1/48"				1/48" increments		1/48"
28	Non-escapement	INA				INA		Yes
29	*Self Test Mode*	INA	INA	Yes	Yes	Yes	Yes	INA
	Operational features							
30	*Cartridge ribbon*	Yes	Yes	INA	INA	Yes	INA	Yes
31	Quiet operation (55 dBa max. noise level)	INA	INA	INA	INA	INA	INA	INA
32	Line-at-a-time printing	No	No	Yes	Yes	No	Yes	No
33	Character-at-a-time printing	Yes	Yes	No	No	Yes	No	Yes
34	Size of buffer memory	256 characters	40 characters	INA	120 characters	128 characters	2 lines (80 char./line)	224 charac
	Panel controls for operation	INA						
35	Power on/off		INA	Yes	INA	Yes	INA	INA
36	Input rates selector		Yes	No	No	Yes	INA	Yes
37	Self test/operator		INA	Yes	No	INA	Yes	INA
	Electrical Interface							
38	Type	RS-232	20 ma current loop RS-232-C	RS-232	INA	RS-232-C	RS-232-C MIL-STD-188C *20/60 ma current loop optional*	RS-232 C 20 ma curr
39	Protocol	INA	INA	INA	INA	INA	INA	INA
40	Input data rates	600 Baud	110, 150 and 300	INA	INA	110, 150, 300 Baud Standard; 1200 Baud optional	Up to 9600 Bits per second	110, 150, 1200 Baud
	Physical dimensions							
41	Depth	INA	21"	28"	27.28"	24"	17-3/8"	18.8"
42	Width	23-1/2"	27.5"	30"	20.375"	28"	17"	23.5"
43	Height	32" (on pedestal)	33.5" (on pedestal)	40-1/2" (on pedestal)	11.56"	9"	6-1/2"	7.625"
44	Weight	61 lbs.	80 lbs.	290 lbs.	83 lbs	INA	67 lbs.	44 lbs.
45	Military specifications conformance	INA	INA	INA	INA	INA	MIL-STD-188C NACSEM 5100	INA
	Power requirements							
46	Voltage (ac)	117V ±10%	120V	115V	117V 10%	120V Std, 240V optional	115V ±10%	95 to 130
47	Current	3 Amp. surge; 2 Amp. avg.	INA	INA	INA	INA	3.15 Amp	INA
48	Frequency	60 Hertz	60 Hertz	60 Hertz	60 Hertz	60 Hertz std; 50 Hertz optional	48-52 or 58-62 Hertz	INA
49	Phases	INA	INA	Single	INA	INA	Single	INA
50	Watts	INA	INA	400 (max)	INA	INA	280	350
	Status displays and indicators	INA			INA		INA	
51	On/Off		INA	No		INA		Yes
52	Standby		INA	No		INA		INA
53	Out of paper		INA	Yes		INA		INA
54	On-line/off-line		INA	No		INA		INA
55	Input rate selection		Yes	No		Yes		No
56	Test/operational		INA	No		INA		INA

N/A - NOT APPLICABLE INA - INFORMATION NOT AVAILABLE

1

	02	03	04	05	06	07	08
	Data General Corp.	Data 100 Corp.	Racal-Milgo (ICC)	Perkin-Elmer Data Systems, Terminal Division	Teletype Corp.	Qume	Data Printer Corp.
ism)	6043	4430 Whisper Quiet	40 + 20C	Carousel 310	4010-8F0D	Sprint 5/45 RO	1260
	INA	INA	INA	INA	$8205.	$2140.	INA
	No	Yes	INA	Yes	Yes	Yes	INA
	5 x 7	INA	INA	No	No	No	No
	INA	Yes	INA	Yes	INA	INA	INA
	INA	Yes	INA	INA	INA	INA	INA
	INA	INA	INA	Yes	INA	Yes	INA
	No	INA	No	10 or 12.5	No	10, 12 or 15	No
	INA	No	INA	No	No	No	No
	No	No	INA	No	No	Yes	No
	INA	INA	Yes	Yes	Yes	Yes	Yes
	30	(300 lines per minute)	(180 lines per minute)	40	3.7 lines/sec. (80 characters/line)	45 (55 optional)	600 line per minute (132 characters per line)
	INA	INA	INA	INA	INA	Yes	INA
	6	6	6	6 or 8	6 or 3	6	6
	INA	INA	No	INA	INA	Yes	INA
	INA	INA	INA	INA	INA	INA	INA
	15"	16"	12-27/32"	15-1/2"	8-1/2"	14.65"	19.5"
	INA	No	Yes	Yes	Yes	Yes	INA
	INA	Yes	No	Optional	Optional	Yes	INA
	INA	INA	INA	INA	INA	5 inches/second	20" per second (40" per second optional)
	INA	INA	INA	INA	INA	INA	INA
	INA	INA	INA		INA		INA
				INA		Yes	
				INA		Yes	
				1/100" increments		1/120"	
				1/48" increments		1/48"	
				INA		Yes	
	INA	Yes	Yes	Yes	Yes	INA	Yes
	Yes	INA	INA	Yes	INA	Yes	INA
	INA	INA	INA	INA	INA	INA	INA
	No	Yes	Yes	No	Yes	No	Yes
	Yes	No	No	Yes	No	Yes	No
	40 characters	INA	120 characters	128 characters	2 lines (80 char./line)	224 characters	INA
	INA	Yes	INA	Yes	INA	INA	INA
	Yes	No	No	Yes	INA	Yes	
	INA	Yes	No	INA	Yes	INA	
	20 ma current loop RS-232-C	RS-232	INA	RS-232-C	RS-232-C MIL-STD-188C 20/60 ma current loop optional	RS-232-C 20 ma current loop	Bit parallel, character serial, TTL compatible
	INA	INA	INA	INA	INA	INA	INA
	110, 150 and 300	INA	INA	110, 150, 300 Baud Standard; 1200 Baud optional	*Up to 9600 Bits per second*	110, 150, 300, 600, 1200 Baud	INA
	21"	28"	27.28"	24"	17-3/8"	18.8"	26"
	27.5"	30"	20.375"	28"	17"	23.5"	36.5"
	33.5" (on pedestal)	40-1/2" (on pedestal)	11.56"	9"	6-1/2"	7.625"	42.75"
	60 lbs.	290 lbs.	83 lbs	INA	67 lbs.	44 lbs.	570 lbs.
	INA	INA	INA	INA	MIL-STD-188C NACSEM 5100	INA	INA
	120V	115V	117V 10%	120V Std, 240V optional	115V ±10%	95 to 130V/200-250V	100/115/200/235
mp. avg.	INA	INA	INA	INA	3.15 Amp	INA	INA
	60 Hertz	60 Hertz	60 Hertz	60 Hertz std; 50 Hertz optional	48-52 or 58-62 Hertz	INA	50 or 60 Hertz ±1 Hertz
	INA	Single	INA	INA	Single	INA	INA
	INA	400 (max)	INA	INA	280	350	0.8 KVA
	INA	No	INA	INA	INA	Yes	INA
	INA	No		INA		INA	
	INA	Yes		INA		INA	
	INA	No		INA		INA	
	Yes	No		Yes		No	
	INA	No		INA		INA	

T APPLICABLE   INA - INFORMATION NOT AVAILABLE

APPENDIX F

MEDIA SELECTION CRITERIA

APPENDIX F

MEDIA SELECTION CRITERIA

LIFE CYCLE COST

The life cycle cost includes all costs over the expected life of the equipment. The initial costs of equipment and programming, costs of spare parts, costs of repairs and maintenance on the equipment and personnel and training costs for operations and maintenance personnel, are the predominate cost elements. Costs for special support equipment for repair and maintenance would also be included, as well as the costs to utilize integrated logistics support concepts.

Cost consideration to be considered for all message entry devices includes:

- Current market price for small buys of equipment offered for military use
- Development costs of up-grading present equipment to military shipboard standards
- Development costs of new equipment designed for military shipboard standards
- Estimated cost of equipments procured in medium size buys after development is completed

PERFORMANCE

Smart Capabilities

Smart capabilities are the functions that can be performed by a terminal or unit in support of the message generation process. Typical smart functions of a terminal would be:

- Generation of pro forma message types for completion by "fill in the blanks"
- Editing of messages after entry
- Interaction of human and machine (e.g., prompting)
- Validation of input data
- Formatting of data and words according to predetermined formats

Versatility

Versatility is the ability to accept changes in existing functions. Some examples of versatility in a terminal would be its programmability to provide different functions, i.e., a half or full duplex capability or a capability to operate at various baud rates.

Expandability

Expandability is the capability to increase the number and type of functions, e.g., in a smart terminal, the size of memory, the instruction set of a processor or the number and type of I/O ports may be increased.

Throughput

Throughput for message entry devices (MEDs) is the number of messages of predetermined length that can be accepted by a device over a relatively long unit of time (i.e., 720 messages of 1920 characters per hour). A minimum standard for throughput should be applied to all types of MEDs. In actual practice, however, the throughput of any automated message generation and preparation system will most likely be limited by the number of message drafters and message generation equipment operators.

Accuracy

Accuracy for MEDs is the error-free alphanumeric characters of symbols that are entered via the MED into the message preparation system. The character error rate indicates the quality of the MED. The quality of the MED is inversely proportional to the number of errors that occur undetected by the MED of the communication system, i.e., as quality goes up, the character errors go down. Also related to accuracy is the ability of the MED to recover as much usable data as possible from magnetic or paper media should they be accidentally damaged during handling.

Ease of Interface

The interface ease is the ease in making electrical or mechanical interfaces with existing equipments and new equipments yet to be introduced in message preparation systems. Using the same interface standards for present and future systems and equipment will ease interface problems. Handshaking signals and procedures as well as binary coded symbols will need to be standardized for present and future systems to ease interfacing problems.

Electrical Interfaces

Considered here are the electrical interfaces to the message preparation system. Examples are:

- RS-232C
- High level and low level TTY loops
- MIL-STD-188C
- NTDS slow
- NTDS fast
- ANEW

IMPACT ON SYSTEM (existing systems)

Administrative Control

This is the management of resources to achieve efficient message generation. Administrative control would need to be exercised only over a small area if there is one message entry point. Administrative control would be dispersed if there are many message entry points making control more complex and difficult.

Security measures and safeguards also would be confined to one area for a single point and dispersed for multiple message entry points. The safeguards would include TEMPEST qualified equipments and areas. Security measures would include operator discipline and training and control of personnel access to message entry equipments and areas. More personnel and facilities are needed for many entry points than for one message entry point.

Processing Control

The processing control pertains only to message entry functions, equipment and procedures. The precedence of a message determines which message is processed first. Messages will be processed only if signed by a person with appropriate release authority. The higher the precedence, the less the writer-to-reader elapsed time in accordance with the requirement.

Replacement of Equipment

New equipment should reduce the number of existing equipments as well as personnel while providing faster message delivery. The amount of new equipment should be kept to a minimum.

Logistic Supportability

The logistic supportability is the ability of the supply system to furnish spare parts for repair and maintenance and the availability of test equipment and properly trained repair and maintenance personnel to keep the message generation system operating. Modularization of equipment using line replaceable items and modules can ease the logistic supportability problems. These problems will also be eased if new systems can be built that require simple or existing test equipment for repair and maintenance.

Commonality of message generation system equipment with other systems can reduce hardware and software development costs and help keep the logistics supportability requirements low. An example would be the use of standard peripherals and computers that will allow common hardware and software to be used in different systems.

Personnel

The number and skill level of operators required to operate message generation equipment would vary depending on the type of media and equipment. The average time spent by the operator for each message entered would indicate which media and equipment can reduce the personnel requirements.

MILITARY SPECIFICATION AVAILABILITY

The following military standards and specifications should be considered for application to message entry devices:

- MIL-STD-167, Mechanical Vibrations of Shipboard Equipment. The Type I environment vibration would apply. An exploratory vibration test should be performed on each candidate for message entry device (MED).
- MIL-S-901, Shock Tests, H. I. (High Impact) Shipboard Machinery Equipment and Systems, Requirements for (NAVY). The MEDs would probably be of a

Grade B, Class II type. A Grade B type is "not required for the safety or continued combat capability of a ship." The "Class II equipment . . . will perform its specified functions, under the HI shock, with the use of resilient mounting which are allowed or required . . . . "

- MIL-E-16400, Electronic Equipment, Naval Ship and Shore, General specification
- MIL-STD-810, Environmental Test Methods
- MIL-STD-1397, Input/Output Interfaces, Standard Digital Data, Navy Systems
- MIL-STD-1472, Human Engineering Design Criteria for Military Systems Equipment and Facilities
- MIL-STD-1671, Mechanical Vibrations of Shipboard Equipment (Type I Environmental and Type II Internally Excited)
- MIL-STD-188, Military Communication System Technical Standards
- MIL-STD-454, Standard General Requirements for Electronic Equipment
- MIL-STD-461, Electromagnetic Interference Characteristics, Requirements for Equipment
- MIL-STD-46855, Human Engineering Requirements for Military Systems, Equipment and Facilities
- NACSEM 5100 (CONFIDENTIAL), Compromising Emanations Laboratory Test Standard Electromagnetics

PHYSICAL CHARACTERISTICS

The primary physical characteristics for MEDs are size and weight. The maximum permissible volume and weight should be determined or design objectives established consistent with performance and capability. Needed are:

- Size and weight of available units
- Design objectives for development
- Estimates of size and weight for production models

POWER CONSUMPTION

The power consumption of present equipments should be noted and the power for developed equipments estimated. A reasonable standard consistent with performance would be helpful in the evaluation of candidate MEDs. A comparison of available MEDs within each type would show which unit uses the least power and has the lowest volt ampere requirements.

ATTACHMENT A

OPTICAL CHARACTER READER FOR THE
AUTOMATED MESSAGE ENTRY SYSTEM

OPTICAL CHARACTER READER (OCR) FOR THE AUTOMATED MESSAGE ENTRY SYSTEM (AMES)

The AMES project at NOSC has resulted in an advanced development model of an automated message preparation system using an OCR for message entry. AMES is equivalent to a Level II system as described in this study report. AMES has been developed for the USMC for use in a tactical environment. The USMC has completed an OPEVAL OF AMES ADM and has entered into an acquisition program to procure 25 production versions with a First Article in January 1981. The Army has also opted to buy AMES in as yet an unspecified quantity. An AMES consists of optical character reader, system controller, magnetic tape cartridge unit, paper tape reader/punch, high speed printer and a keyboard video display terminal in an S-280 hut and is projected to cost $210K per unit in production.

The OCR in the AMES ADM and AMES feasibility model has been a commercial version, Control Data Corporation 92650 (presently sold as a Scan Data Corporation 1150). During the course of system development and testing (three years), NOSC has logged a total of 5100 hours of usage on two machines. During this period the OCR(s) experienced eight failures. The details are presented in enclosure (1) to this Attachment A.

Exhibits 1 through 16 provide examples of messages accepted by the AMES. Particular attention is called to the fact that the AMES OCR does not require letter perfect copy and is, in fact, able to read misaligned characters, skewed lines, violated margins, stained and wrinkled copies, improper spacings, smudged characters, degraded print, etc. The AMES system also permits character, word and line delete as well as line(s) insert by the use of correction pages.

The input is prepared on red DD-173 forms with electric typewriters using an OCR A font, once only polyethylene ribbon and 10 character pitch. The output for the exhibits was taken from the line printer after the system has assigned RIs and reformatted the message to the operator selected ACP 126 Mod, ACP 127 or JANAP 128 format.

Table AA1 provides technical specifications on the CDC92650.

ATTACHMENT A

Table AA1. CDC 92650 – Technical specifications.

Character recognition rate	684 characters/second
Page throughput	5 pages/minute
Maximum character substitution rate (ANSI print quality range X)(1)	1/100,000
Maximum character reject rate (ANSI print quality range X)(1)	1/10,000
Maximum character substitution rate (ANSI print quality range Y)(1)	1/50,000
Maximum character reject rate (ANSI print quality range Y(1)	1/5,000
Maximum line skew permitted(2)	±0.13 inches
Maximum character skew permitted(2)	±2° Angular rotation
Maximum character misalignment permitted(2)	±1/2 Character height vertically
Minimum adjacent character separation permitted(2)	0.014 inches
Minimum print contrast signal permitted (2)	50%

NOTES:

1. Typical reading accuracy is an order of magnitude higher than those specified.
2. Reading tolerance is based on character spacing of 10 characters/inch and line spacing of 3 lines/inch.

AMES OCR RELIABILITY DATA

During development, test and evaluation of the AMES feasibility model and the AMES advanced development model, NOSC obtained the following reliability data on the Control Data Corporation 92650 terminal optical character reader (TOCR).

I. AMES feasibility model (TOCR S/N 1 was used; this unit is a preproduction model)

A. Two months at NOSC (9/75–10/75)

1. Approximate number of operating hours was 480
2. One failure occurred
   a. Bad comparator PC card
   b. Corrective maintenance performed by NOSC engineer

B. Three months at First Marine Division, Camp Pendleton, CA (11/75–1/76) for operational testing; in a garrison environment

1. Approximate number of operating hours was 600
2. No failures occurred

C. Two months at NOSC (7/77–8/77)

1. Approximate number of operating hours was 100
2. One failure occurred
   a. Bad comparator PC card (received from contractor with defect)
   b. Corrective maintenance performed by NOSC engineer

D. One month in Germany for REFORGER 77 (9/77); in a garrison environment

1. Approximate number of operating hours was 340
2. No failures occurred; however, the CDC engineering supporting the TOCR made four circuit modifications
   a. Two modifications were required to compensate for heat sensitive components; these heat problems have been corrected in the production models of the TOCR
   b. The other two modifications should have been made six months earlier, but factory technicians failed to do so

II. AMES advanced development model (TOCR S/N 146 was used)

A. Twelve months at NOSC (4/77–3/78)

1. Approximate number of operating hours was 2080
2. Four failures occurred:
   a. Bad display generator PC card; corrective maintenance done by CDC technician (received from contractor with defect)

Enclosure 1 to Attachment A

b. Bad power supply TRIAC; corrective maintenance done by NOSC engineer

c. Bad solid state array used in the optics; corrective maintenance done by CDC engineer

d. Bad encoder PC card; corrective maintenance done by NOSC engineer

B. One month at First Marine Division, Camp Pendleton, CA (4/78) for operational testing; in a garrison environment

1. Approximate number of operating hours was 420
2. One failure occurred:
   a. Bad eject stacker motor control PC card
   b. Corrective maintenance done by NOSC engineer

C. Three weeks at Camp Pendleton, CA (5/78) for transportability testing; tactical environment; NOSC installed shock mounts on the TOCR and added mechanical stiffeners such as card retainers, cable connector retainers and panel latches

1. Approximate number of operating hours was 100
2. No failures occurred

NOTE: Not included in the above information are the following two problems which were investigated by the CDC engineer

1. Timing problem (actually a design error) on the format controller PC card; a circuit modification was made by the CDC engineer as a temporary solution to the problem
2. Fault detect logic card falsely indicated an error in the optic alignment; the CDC engineer determined the optics were in perfect alignment, but could not solve the problem; this does not in anyway affect the TOCR's reading abilities

D. Three months (6/78–8/78) at various locations (NOSC, East Coast, Germany) for the purpose of demonstrations (AFCEA, USAREUR)

1. Approximate number of operating hours was 480
2. No failures occurred

E. One month in Germany for REFORGER 78 (9/78); in a garrison environment

1. Approximate number of operating hours was 340
2. One failure occurred
   a. Bad fault detect logic PC card
   b. Corrective maintenance performed by CDC technician

F. Two months (10/78–11/78) on East Coast for demonstrations at various locations

1. Approximate number of operating hours was 160
2. No failures occurred

Approximate total operating hours as of 12/18/78 is 5,100.

Total number of failures as of 12/18/78 was eight.

JOINT MESSAGEFORM							SECURITY CLASSIFICATION
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY (DATE - TIME / MONTH / YR)
01 OF 02	1600945	RR	RR	AT	UUUU	ZYUW	

BOOK

MESSAGE HANDLING INSTRUCTIONS

FROM: CG FIRST MARDIV

TO: CG MCDEC QUANTICO VA

CMC WASHINGTON DC

UNCLAS //N55768//

THE AUTOMATED MESSAGE ENTRY SYSTEM {AMES} IS DESIGNED TO PROVIDE AUTOMATED MESSAGE PREPARATION SUPPORT TO FACILITATE OUTGOING MESSAGE PROCESSING FOR COMMAND AND CONTROL COMMUNICATIONS. AMES WILL REDUCE OPERATOR WORK LOADS AND PROVIDE A MORE EFFICIENT, RELIABLE, AND RAPID OUTGOING MESSAGE PROCESSING CAPABILITY. AMES ACCEPTS OUTGOING MESSAGES ENTERED IN DD-173 FORMAT, VALIDATES SELECTED ELEMENTS OF THE MESSAGE, ASSIGNS ROUTING INDICATORS, FORMATS THE MESSAGE FOR TRANSMISSION, AND TRANSMITS THE MESSAGE TO AUTODIN VIA AN INTERFACED AN/TYC-5A TERMINAL DEVICE AND/OR TO A PAPER TAPE UNIT FOR MANUAL PROCESSING ON OTHER CIRCUITS. THE SYSTEM ALSO MAINTAINS FILES AND LOGS OF OUTGOING MESSAGES PROCESSED VIA THE SYSTEM FOR MESSAGE
6 ACCOUNTABILITY AND/OR SUBSEQUENT RETRIEVAL. AMES USES STATE-OF-THE-
5
4 ART OPTICAL CHARACTER READER {OCR} AND MICRO-PROCESSOR TECHNOLOGY
3
2 TO VISUALLY READ TYPED DD-173 MESSAGE FORMS AND CONVERT THE CHARAC-
1
0 TERS INTO COMPUTER ACCEPTABLE DIGITAL FORMAT. AMES IS INTENDED FOR

DISTR.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF-001-6000 GPO: 1976-206-019 Exhibit 1

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY
02 of 02	1600945					DATE-TIME MONTH YR

MESSAGE HANDLING INSTRUCTIONS

TACTICAL DEPLOYMENT IN A STANDARD SHELTER CONFIGURATION.

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DRAFTER TYPED NAME TITLE OFFICE SYMBOL PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER TYPED NAME TITLE OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 GPO 1976 Exhibit 1

```
RATUZYUW RUWJDFN0001 1640846-UUUU--RUEACMC RUEBJMA.
ZNR UUUUU
R 130846Z JUN 78
FM CG FIRST MARDIV
TO RUEBJMA/CG MCDEC QUANTICO VA
RUEACMC/CMC WASHINGTON DC
BT
UNCLAS //N55768//
THE AUTOMATED MESSAGE ENTRY SYSTEM (AMES) IS DESIGNED TO PROVIDE
AUTOMATED MESSAGE PREPARATION SUPPORT TO FACILITATE OUTGOING MESSAGE
PROCESSING FOR COMMAND AND CONTROL COMMUNICATIONS. AMES WILL REDUCE
OPERATOR WORK LOADS AND PROVIDE A MORE EFFICIENT, RELIABLE, AND
RAPID OUTGOING MESSAGE PROCESSING CAPABILITY. AMES ACCEPTS OUTGOING
MESSAGES ENTERED IN DD-173 FORMAT, VALIDATES SELECTED ELEMENTS OF
THE MESSAGE, ASSIGNS ROUTING INDICATORS, FORMATS THE MESSAGE FOR
TRANSMISSION, AND TRANSMITS THE MESSAGE TO AUTODIN VIA AN INTERFACED
AN/TYC-5A TERMINAL DEVICE AND/OR TO A PAPER TAPE UNIT FOR MANUAL
PROCESSING ON OTHER CIRCUITS. THE SYSTEM ALSO MAINTAINS FILES AND
LOGS OF OUTGOING MESSAGES PROCESSED VIA THE SYSTEM FOR MESSAGE
ACCOUNTABILITY AND/OR SUBSEQUENT RETRIEVAL. AMES USES STATE-OF-THE-
ART OPTICAL CHARACTER READER (OCR) AND MICRO-PROCESSOR TECHNOLOGY
TO VISUALLY READ TYPED DD-173 MESSAGE FORMS AND CONVERT THE CHARAC-


PAGE 2 RUWJDFN0001 UNCLAS
TERS INTO COMPUTER ACCEPTABLE DIGITAL FORMAT. AMES IS INTENDED FOR
TACTICAL DEPLOYMENT IN A STANDARD SHELTER CONFIGURATION.
BT
#0001


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Exhibit 1

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE - TIME	MONTH	YR
01 OF 01	1631200	RR	RR	AT	EEEE	ZYUW				

BOOK	MESSAGE HANDLING INSTRUCTIONS

FROM: CG FIRST MARDIV

TO: ZEN/FIRST MARDIV

NAVOCEANSYSCEN SAN DIEGO CA

INFO ZEN/CG MCB CAMP PENDLETON CA

3RD MAW NORTON AFB CA

XMT SECOND BN SEVENTH MAR

THIRD BN SEVENTH MAR

UNCLAS E F T O //N02000//

MESSAGES TYPED ON DD-173 MESSAGE FORMS FOR PROCESSING BY THE AMES DO NOT HAVE TO BE TREATED WITH TENDER LOVING CARE. IT IS WELL KNOWN THAT WHEN MESSAGES ARE BEING STAFFED THEY DO GET HANDLED A LOT AND CAN GET DIRTY, SMUDGED, OR EVEN STAINED WITH COFFEE AS THIS ONE DID.

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DISTR:

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE	
SIGNATURE	SECURITY CLASSIFICATION / DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102-LF-001-6000 ☆ GPO: 1976—206-619 Exhibit 2

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RATEZYUW RUWJDFN0006 1640850-EEEE--RUAABBC RUWDSAA.
ZNY EEEEE
R 130851Z JUN 78
FM CG FIRST MARDIV
TO ZEN/FIRST MARDIV
RUWDSAA/NAVOCEANSYSCEN SAN DIEGO CA
INFO ZEN/CG MCB CAMP PENDLETON CA
RUAABBC/63RD MAW NORTON AFB CA
XMT SECOND BN SEVENTH MAR
THIRD BN SEVENTH MAR
BT
UNCLAS E F T O //N02000//
MESSAGES TYPED ON DD-173 MESSAGE FORMS FOR PROCESSING BY THE AMES
DO NOT HAVE TO BE TREATED WITH TENDER LOVING CARE. IT IS WELL KNOWN
THAT WHEN MESSAGES ARE BEING STAFFED THEY DO GET HANDLED A LOT AND
CAN GET DIRTY, SMUDGED, OR EVEN STAINED WITH COFFEE AS THIS ONE DID.
BT
#0006



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Exhibit 2

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE TIME	MONTH YR
01 OF 01	1601103	RR RR	AT	UUUU	ZYUW	4321	091830Z	JUN 78

MESSAGE HANDLING INSTRUCTIONS

FROM CG FI[redacted]RST MARDIV

[redacted] CMC WASHINGTON DC

INFO CG MCDEC QUANT[redacted]IC[redacted]O V[redacted]A

UNCLAS //N77889// [redacted]

ONE ADVANTAGE OF OCR PROCESSIN[redacted]G IS THAT TYPI[redacted]NG ERRORS A[redacted]RE

EAS[redacted]I[redacted]LY CORR[redacted]ECTED [redacted]WITH THE A[redacted]ID [redacted]OF THE BLOB

CH[redacted]A[redacted]R[redacted]ACTE[redacted]R. NN[redacted]NN

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE	
SIGNATURE	SECURITY CLASSIFICATION / DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 Exhibit 3

```
RATUZYUW RUWJDFN4321 1640849-UUUU--RUEACMC RUEBJMA.
ZNR UUUUU
R 091830Z JUN 78
FM CG FIRST MARDIV
TO RUEACMC/CMC WASHINGTON DC
INFO RUEBJMA/CG MCDEC QUANTICO VA
BT
UNCLAS //N77889//
ONE ADVANTAGE OF OCR PROCESSING IS THAT TYPING ERRORS ARE
EASILY CORRECTED WITH THE AID OF THE BLOB
CHARACTER.
BT
#4321




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Exhibit 3

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT / INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER
01 OF 01	1630930	RR RR	AT	U	UUEUUZYUW	

MESSAGE HANDLING INSTRUCTIONS

FROM NAVOCEANSYSCEN SAN DIEGO CA

TO CG MCDEC QUANTICO VA

UNCLAS //N15432//

THE OCR CAN READ MISALIGNED CHARACTERS.

ALSO SKEWED CHARACTERS.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR)

S/N 0102-LF-001-6000

Exhibit 4

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RATUZYUW RUWJDFN0005 1640849-UUUU--RUEBJMA.
ZNR UUUUU
R 130850Z JUN 78
FM NAVOCEANSYSCEN SAN DIEGO CA
TO CG MCDEC QUANTICO VA
BT
UNCLAS //N15432//
THE OCR CAN READ MISALIGNED CHARACTERS.
ALSO SKEWED CHARACTERS.
BT
#0005




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Exhibit 4

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE TIME	MONTH YR
01 OF 01	1630912	PP	PP	AT	UUUU	ZYUW	1223	121637Z	JUN 78

BOOK

MESSAGE HANDLING INSTRUCTIONS

FROM: CG FIRST MARDIV

TO: CMC WASHINGTON DC

UNCLAS ■■//N11224//

THE OCR CAN READ SKEWED LINES

EITHER TO THE LEFT OR ■RIGHT

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 GPO: 1976-206 619 Exhibit 5

```
PATUZYUW RUWJDFN1223 1640850-UUUU--RUEACMC.
ZNR UUUUU
P 121637Z JUN 78
FM CG FIRST MARDIV
TO CMC WASHINGTON DC
BT
UNCLAS //N11224//
THE OCR CAN READ SKEWED LINES
EITHER TO THE LEFT OR RIGHT
BT
#1223



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Exhibit 5

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY
						DATE TIME MONTH YR

01 01 1631400 RR RR AT UUUU ZYUW

BOOK MESSAGE HANDLING INSTRUCTIONS

FROM CG FIRST MARDIV

TO NAVOCEANSYSCEN SAN DIEGO CA

UNCLAS //N02000//

THIS MESSAGE DEMONSTRATES THAT EVEN THOUGH A MESSAGE IS ALIGNED TO FA(

TO THE RIGHT IN THE TYPEWRITER THE OPTICAL CHARACTER READER IS ABLE TO

PICK UP THE CHARACTERS AND PROCESS THE MESSAGE.

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DRAFTER TYPED NAME TITLE OFFICE SYMBOL PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER TYPED NAME TITLE OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR)

S/N 0102 LF 001 6000

GPO 1976-700-619 Exhibit 6

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RATUZYUW RUWJDFN0007 1640850-UUUU--RUWDSAA.
ZNR UUUUU
R 130852Z JUN 78
FM CG FIRST MARDIV
TO NAVOCEANSYSCEN SAN DIEGO CA
BT
UNCLAS //N02000//
THIS MESSAGE DEMONSTRATES THAT EVEN THOUGH A MESSAGE IS ALIGNED TO FAR
TO THE RIGHT IN THE TYPEWRITER THE OPTICAL CHARACTER READER IS ABLE TO
PICK UP THE CHARACTERS AND PROCESS THE MESSAGE.
BT
#0007




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```

Exhibit 6

JOINT MESSAGEFORM	SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY
01 01	163133б	RR RR	AT	UUUU	ZYUW	

FROM CG MCDEC QUANTICO VA

TO CG FIRST MARDIV

UNCLAS //N02000//

THIS MESSAGE DEMONSTRATES THAT EVEN THOUGH THE MESSAGE IS NOT ALIGNED CORRECTLY IN THE TYPEWRITER, THE OCR CAN STILL PICK UP THE CHARACTERS THAT ARE TYPED TO FAR TO THE LEFT.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS
RELEASER TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE	
SIGNATURE	SECURITY CLASSIFICATION / DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 Exhibit 7

```
RATUZYUW RUWJDFN0008 1640851-UUUU--.
ZNR UUUUU
R 130853Z JUN 78
FM CG MCDEC QUANTICO VA
TO CG FIRST MARDIV
BT
UNCLAS //N02000//
THIS MESSAGE DEMONSTRATES THAT EVEN THOUGH THE MESSAGE IS NOT ALIGNED
CORRECTLY IN THE TYPEWRITER, THE OCR CAN STILL PICK UP THE CHARACTERS
THAT ARE TYPED TO FAR TO THE LEFT.
BT
#0008




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Exhibit 7

JOINT MESSAGEFORM

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE	LMF	CLASS	CIC
01 OF 01	1631425	RR RR	AT	UUUU	ZYUW

FROM CG FIRST MARDIV

TO CG MCDEC QUANTICO VA

UNCLAS //N02000//

THIS MESSAGE WILL BE USED ■TO DEMONSTRATE THAT EVEN THOUGH A MESSAGE IS NOT DOUBLED SPACED AS IS IT SUPPOSE TO BE, THE OPTICAL CHARACTER CHARACTER READ■■ER IS STILL ABLE TO READ IT.

THE REST OF THE MESSAGE IS MEANINGLESS EXCEPT THAT IT SHOWS THE VARIATIONS IN SPACING BETWEEN LINES.

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5 4 RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYR

3 2 RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYR

1 0 RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY NNNN

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE | SPECIAL INSTRUCTIONS

RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE | SECURITY CLASSIFICATION | DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 GPO 1976-206-619 Exhibit 8

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RATUZYUW RUWJDFN0009 1640851-UUUU--RUEBJMA.
ZNR UUUUU
R 130854Z JUN 78
FM CG FIRST MARDIV
TO CG MCDEC QUANTICO VA
BT
UNCLAS //N02000//
THIS MESSAGE WILL BE USED TO DEMONSTRATE THAT EVEN THOUGH A MESSAGE
IS NOT DOUBLED SPACED AS IS IT SUPPOSE TO BE, THE OPTICAL CHARACTER
CHARACTER READER IS STILL ABLE TO READ IT.
THE REST OF THE MESSAGE IS MEANINGLESS EXCEPT THAT IT SHOWS THE
VARIATIONS IN SPACING BETWEEN LINES.
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYR-RYRYRYRYRYH
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYR
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYR
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PAGE 2 RUWJDFN0009 UNCLAS
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
BT
#0009




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Exhibit 8

JOINT MESSAGEFORM | SECURITY CLASSIFICATION

PAGE | DRAFTER OR RELEASER TIME | PRECEDENCE ACT INFO | LMF | CLASS | CIC | FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY | DATE TIME MONTH YR

01 01 1631840 PP PP AT EEEE ZYUW

MESSAGE HANDLING INSTRUCTIONS

FROM CG FIRST MAR DIV

TO CG FMF PAC

CG FMF LANT

INFO CMC WASHINGTON D.C.

CG MCDEC QUANTICO VA.

63RD MAW NORTON A.F.B. CA.//CODE 3394//

UNCLAS E F T O //N02255//

THIS MESSAGE IS USED TO DEMONSTRATE THAT ROUTING INDICATOR {RI}
ASSIGNMENTS CAN BE MADE EVEN IF THE PLA'S DO NOT LINE UP {AT TAB STOP
26. NOTE ALSO THAT ONLY ALPHA CHARACTERS AND NUMERICS ARE USED TO
FIND A MATCH IN THE PLA/RI FILE. PUNCTUATION AND EXTRA SPACES IN
PLA'S WILL NOT CAUSE THE PLA TO BE REJECTED OR REQUIRE OPERATOR
INTERVENTION TO KEY IN A RI. ALSO, INTER-OFFICE ROUTING CAN BE
LISTED IMMEDIATELY AFTER THE PLA. DOUBLED SLANT SIGNS ARE USED.
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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE | SPECIAL INSTRUCTIONS

RELEASER | TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE | SECURITY CLASSIFICATION | DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102-LF-001-6000 Exhibit

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PATEZYUW RUWJDFN0011 1640951-EEEE--RUAABBC RUEACMC RUEBJMA RUEOLFA
RUHQHQA.
ZNY EEEEE
P 130952Z JUN 78
FM CG FIRST MAR DIV
TO RUHQHQA/CG FMF PAC
RUEOLFA/CG FMF LANT
INFO RUEACMC/CMC WASHINGTON D.C.
RUEBJMA/CG MCDEC   QUANTICO VA.
RUAABBC/63RD MAW NORTON A.F.B. CA.//CODE 3394//
BT
UNCLAS E F T O //N02255//
THIS MESSAGE IS USED TO DEMONSTRATE THAT ROUTING INDICATOR (RI)
ASSIGNMENTS CAN BE MADE EVEN IF THE PLA'S DO NOT LINE UP (AT TAB STOP
26. NOTE ALSO THAT ONLY ALPHA CHARACTERS AND NUMERICS ARE USED TO
FIND A MATCH IN THE PLA/RI FILE. PUNCTUATION AND EXTRA SPACES IN
PLA'S WILL NOT CAUSE THE PLA TO BE REJECTED OR REQUIRE OPERATOR
INTERVENTION TO KEY IN A RI. ALSO, INTER-OFFICE ROUTING CAN BE
LISTED IMMEDIATELY AFTER THE PLA. DOUBLED SLANT SIGNS ARE USED.
BT
#0011




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Exhibit 9

JOINT MESSAGEFORM							SECURITY CLASSIFICATION			
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE TIME	MONTH	YR
01 OF 01	1601114	PP	PP	AT	UUUU	ZYUW	8989	091845Z	JUN	78

BOOK

MESSAGE HANDLING INSTRUCTIONS

FROM CG FIRST MARDIV

INFO MCAS YUMA AZ

CMC WASHINGTON DC

~~GC MDCED QUINTAKO VG~~

CG MCDEC QUANTICO VA

UNCLAS //N11221//

THE TYPIST ALSO HAS THE CAPABILITY TO DELETE AN ENTIRE LINE BY USING TWENTY OR MORE LONG DASHES. THESE ARE TYPED OVER THE CHARACTERS AS SHOWN BELOW:

~~LINE 5 OF THE THES~~ WILL BE DELETED CENTS I MADF SO MA NY MISTEAKSSS.

THIS LINE WILL BE COPIED. NNNN

DISTR.

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS	
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE		
SIGNATURE	SECURITY CLASSIFICATION	DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102-LF-001-6000 GPO: 1976-206-613

Exhibit 1C

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PATUZYUW RUWJDFN8989 1640849-UUUU--RUEACMC RUEBJMA RUWJMRA.
ZNR UUUUU
P 091845Z JUN 78
FM CG FIRST MARDIV
INFO RUWJMRA/MCAS YUMA AZ
RUEACMC/CMC WASHINGTON DC
RUEBJMA/CG MCDEC QUANTICO VA
BT
UNCLAS //N11221//
THE TYPIST ALSO HAS THE CAPABILITY TO DELETE AN ENTIRE LINE BY USING
TWENTY OR MORE LONG DASHES. THESE ARE TYPED OVER THE CHARACTERS AS
SHOWN BELOW:
THIS LINE WILL BE COPIED.
BT
#8989



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Exhibit 10

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE	LMF	CLASS	CIC	FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY	DATE TIME MONTH YR
01 02	1601124	00 RR AT		UUUU	ZYUW	2234	091902Z JUN 78

FROM NAVOCEANSYSCEN SAN DIEGO CA

TO CG FIRST MARDIV

INFO CG MCDEC QUANTICO VA

UNCLAS //N11221//

THIS IS A TEST MESSAGE TO DEMONSTRATE AUTOMATIC EDITING OF TYPED

DD|173|MESSAGE|FORMS. THEREFORE, THE RELEASING AUTHORITY KNOWS THAT

~~ONLY WHAT IS CONTAINE~~

THE|MESSAGE|IS|TRANSMITTED EXACTLY AS TYPED.

THE REST OF THIS PAGE WILL BE MEANINGLESS.

ASDF ASDF ASDF ASDF ASDF

ABC ABC DEF DEF GHI GHI

RY RY RY RY RY RY RY RY

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890

AAA BBB CCC DDD EEE FFF GGG HHH III JJJ KKK LLL MMM NNN OOO PPP QQQ

RRR SSS TTT UUU VVV WWW XXX YYY ZZZ

6 1 2 3 4 5 6 7 8 9 0 9 8 7 6 5 4 3 2 1

5

4 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

3

2 1 2 3 4 5 6 7 8 9 0 9 8 7 6 5 4 3 2 1

1

0 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

DISTR

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DRAFTER TYPED NAME TITLE OFFICE SYMBOL PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER TYPED NAME TITLE OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR)

S/N 0102-LF-001-6000

GPO 1978-700-61 Exhibit 11

JOINT MESSAGEFORM

PAGE | DRAFTER OR RELEASER TIME | PRECEDENCE | LMF | CLASS

01 OF 02 1601124

DD-173 MESSAGE FORMS. USING THIS METHOD THE ORIGINATOR CAN EDIT A MESSAGE WITHOUT HAVING THE ENTIRE MESSAGE RETYPED. ALSO, THE RELEASING AUTHORITY IS ASSURED THAT THE MESSAGE WILL BE TRANSMITTED ~~EXACTLY AS TYPED. TH~~E REST OF THIS PAGE WILL BE EXACTLY AS TYPED.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

RELEASER TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

DD FORM 1 JUL 73 173

S/N 0102-LF

Exhibit

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY
02 OF 02	1601124					DATE TIME

BOOK

MESSAGE HANDLING INSTRUCTIONS

THIS PAGE WILL BE MEANINGLESS ALSO.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 GPO 1976-200 Exhibit 1

```
OATUZYUW RUWJDFN2234 1640949-UUUU--RUEBJMA.
ZNR UUUUU
O R 091902Z JUN 78
FM NAVOCEANSYSCEN SAN DIEGO CA
TO RUWJDFN/CG FIRST MARDIV
INFO RUEBJMA/CG MCDEC QUANTICO VA
BT
UNCLAS //N11221//
THIS IS A TEST MESSAGE TO DEMONSTRATE AUTOMATIC EDITING OF TYPED
DD-173 MESSAGE FORMS. USING THIS METHOD THE ORIGINATOR CAN EDIT A
MESSAGE WITHOUT HAVING THE ENTIRE MESSAGE RETYPED. ALSO, THE RELEAS-
ING AUTHORITY IS ASSURED THAT THE MESSAGE WILL BE TRANSMITTED
EXACTLY AS TYPED.
THE REST OF THIS PAGE WILL BE MEANINGLESS.
ASDF  ASDF  ASDF  ASDF  ASDF
ABC  ABC  DEF  DEF  GHI  GHI
RY  RY  RY  RY  RY  RY  RY  RY
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
AAA BBB CCC DDD EEE FFF GGG HHH III JJJ KKK LLL MMM NNN OOO PPP QQQ
RRR SSS TTT UUU VVV WWW XXX YYY ZZZ
1  2  3  4  5  6  7  8  9  0  9  8  7  6  5  4  3  2  1
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z


PAGE 2 RUWJDFN2234 UNCLAS
1 2 3 4 5 6 7 8 9 0 9 8 7 6 5 4 3 2 1
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
THIS PAGE WILL BE MEANINGLESS ALSO.
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG
HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
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KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK
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MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
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#2234



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Exhibit 11

JOINT MESSAGEFORM							SECURITY CLASSIFICATION				
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE	TIME	MONTH	YR
01 OF 02	1631300	RR	RR	AT	UUUU	ZYUW					

BOOK

MESSAGE HANDLING INSTRUCTIONS

FROM: CG FIRST MARDIV

TO: CG FMFPAC

UNCLAS //N02000//

THIS MESSAGE WILL BE USED TO DEMONSTRATE THAT LINE DELETES AND EDITING OF MESSAGES CAN BE DONE FREE HAND.

~~THIS LINE WILL BE O~~MITTED FROM THE TEXT OF THIS MESSAGE.

~~THIS LINE WILL ALSO~~ BE LEFT OUT OF THE TEXT OF THIS MESSAGE.

~~AND SO WILL THIS LI~~NE.

THE REMAINDER OF THE TEXT ON THIS PAGE WILL BE MEANINGLESS.

RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY

ABABABABABABABABA-ABABABABABABABAB

RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY

ABCD ABCD ABCD ABCD ABCD ABCD ABCD

EFGH EFGH EFGH EFGH EFGH EFGH EFGH

IJKL IJKL IJKL IJKL IJKL IJKL IJKL

MNOP MNOP MNOP MNOP MNOP MNOP MNOP

QRST QRST QRST QRST QRST QRST QRST

UVWX UVWX UVWX UVWX UVWX UVWX UVWX

YZ YZ YZ YZ YZ YZ YZ YZ YZ YZ UVWX NNNN

DISTR:

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS	
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE		
SIGNATURE	SECURITY CLASSIFICATION	DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF-001 6000 GPO: 1976-206-619 Exhibit 12

JOINT MESSAGEFORM								SECURITY CLASSIFICATION			
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE		LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY				
		ACT	INFO					DATE	TIME	MONTH	YR
01 OF 02	1631300										

BOOK | MESSAGE HANDLING INSTRUCTIONS

THIS PARAGRAPH WILL BE PLACED IN THE MESSAGE WHERE THE EDITING TOOK PLACE.

TO:

THIS SENTENCE WILL ALSO BE ADDED.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS	
RELEASER — TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE		
SIGNATURE	SECURITY CLASSIFICATION	DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102-LF-001-6000 GPO: 1976—206-619 Exhibit 12

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RATUZYUW RUWJDFN0010 1640851-UUUU--RUHQHGA.
ZNR UUUUU
R 130855Z JUN 78
FM CG FIRST MARDIV
TO CG FMFPAC
BT
UNCLAS //N02000//
THIS MESSAGE WILL BE USED TO DEMONSTRATE THAT LINE DELETES AND
EDITING OF MESSAGES CAN BE DONE FREE HAND.
THIS PARAGRAPH WILL BE PLACED IN THE MESSAGE WHERE THE EDITING TOOK
PLACE.
THIS SENTENCE WILL ALSO BE ADDED.
THE REMAINDER OF THE TEXT ON THIS PAGE WILL BE MEANINGLESS.
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
ABABABABABABABABA-ABABABABABABABAB
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
ABCD ABCD ABCD ABCD ABCD ABCD ABCD
EFGH EFGH EFGH EFGH EFGH EFGH EFGH
IJKL IJKL IJKL IJKL IJKL IJKL IJKL
MNOP MNOP MNOP MNOP MNOP MNOP MNOP
QRST QRST QRST QRST QRST QRST QRST
UVWX UVWX UVWX UVWX UVWX UVWX UVWX


PAGE 2 RUWJDFN0010 UNCLAS
YZ YZ YZ YZ YZ YZ YZ YZ YZ YZ UVWX
BT
#0010


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Exhibit 12

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE | DRAFTER OR RELEASER TIME | PRECEDENCE ACT INFO | LMF | CLASS | CIC | FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY

01 OF 01 160102Z QQ RR AT UUUU ZYUW

BOOK | MESSAGE HANDLING INSTRUCTIONS

FROM CG FIRST MARDIV

TO CG FMFLANT

INFO CMC WASHINGTON DC

UNCLAS //N22563//

THE DD-173 HEADER LINE CONTAINS AN INVALID ACTION PRECEDENCE.

HEADER ERRORS ARE CORRECTED BY THE OPERATOR VIA THE KEYBOARD

DISPLAY TERMINAL.

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102 LF 001 6000 GPO 1976 Exhibit 13

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OATUZYUW RUWJDFN0003 1640847-UUUU--RUEACMC RUEOLFA.
ZNR UUUUU
O R 130848Z JUN 78
FM CG FIRST MARDIV
TO RUEOLFA/CG FMFLANT
INFO RUEACMC/CMC WASHINGTON DC
BT
UNCLAS //N22563//
THE DD-173 HEADER LINE CONTAINS AN INVALID ACTION PRECEDENCE.
HEADER ERRORS ARE CORRECTED BY THE OPERATOR VIA THE KEYBOARD
DISPLAY TERMINAL.
BT
#0003



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Exhibit 13

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE TIME	MONTH	YR
01 OF 01	160103Z	PP	PP	AT	UUUUU	ZYUW	4522	091236Z	JUN	78

BOOK

MESSAGE HANDLING INSTRUCTIONS

FROM: CG FIRST MARDIV

TO: CMIO SAN DIEGO CA

INFO CMC WASHINGTON DC

CG MCDEC QUANTICO VA

C O N F I D E N T I A L //N12343//

NO CLASSIFIED INFORMATION IS CONTAINED IN THIS TEST MESSAGE.

THIS MESSAGE HAS A SECURITY ■MISMATCH. THE TEXT CLASSIFICATION DOES NOT AGREE WITH THE DD-173 HEADER LINE, SO THE MESSAGE WILL BE AUTOMATICALLY ABORTED.

NNNN

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DISTR:

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DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102-LF-001-6000 GPO: 1976-200-619 Exhibit 14

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PATCZYUW RUWJDFN4522 1640847-CCCC--RUEACMC RUEBJMA RUWDXAA.
ZNY CCCCC
P 091736Z JUN 78
FM CG FIRST MARDIV
TO RUWDXAA/CMIO SAN DIEGO CA
INFO RUEACMC/CMC WASHINGTON DC
RUEBJMA/CG MCDEC QUANTICO VA
BT
C O N F I D E N T I A L //N12343//
NO CLASSIFIED INFORMATION IS CONTAINED IN THIS TEST MESSAGE.
THIS MESSAGE HAS A SECURITY MISMATCH. THE TEXT CLASSIFICATION DOES
NOT AGREE WITH THE DD-173 HEADER LINE, SO THE MESSAGE WILL BE
AUTOMATICALLY ABORTED.
BT
#4522



NNNN
```

Exhibit 14

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

01 01 1601055 PP RR AT UUUU ZYUW

FROM NAVOCEANSYSCEN SAN DIEGO CA

TO CG FIRST MARDIV

CG MCB CAMP PENDLETON CA

INFO CMC WASHINGTON D.C.

ZEN/CG MCDEC QUANTICO VA

AFCEA WASHINGTON DC

MARBKS WASHINGTON DC

DA WASHINGTON DC

UNCLAS//N22113//

IF A PLA IS NOT CONTAINED IN THE PLA/RI FILE, THE OPERATOR IS ASKED TO SUPPLY A ROUTING INDICATOR AND ASSOCIATED CLASSIFICATION CHARACTER, USE THE INTERCEPT RI, OR INDICATE ZEN FOR THAT PLA.

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DISTR

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DRAFTER TYPED NAME TITLE OFFICE SYMBOL PHONE & DATE | SPECIAL INSTRUCTIONS

TYPED NAME TITLE OFFICE SYMBOL AND PHONE

SIGNATURE | SECURITY CLASSIFICATION | DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR)

S/N 0102-LF-001-6000

Exhibit 15

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PATUZYUW RUWJDFN0004 1640848-UUUU--RUAFCEA RUEACMC RUWJDFC.
ZNR UUUUU
P R 130849Z JUN 78
FM NAVOCEANSYSCEN SAN DIEGO CA
TO RUWJDFN/CG FIRST MARDIV
RUWJDFC/CG MCB CAMP PENDLETON CA
INFO RUEACMC/CMC WASHINGTON D.C.
ZEN/CG MCDEC QUANTICO VA
RUAFCEA/AFCEA WASHINGTON DC
ZEN/MARBKS WASHINGTON DC
RUWJDFC/DA WASHINGTON DC
BT
UNCLAS//N22113//
IF A PLA IS NOT CONTAINED IN THE PLA/RI FILE, THE OPERATOR IS ASKED
TO SUPPLY A ROUTING INDICATOR AND ASSOCIATED CLASSIFICATION
CHARACTER, USE THE INTERCEPT RI, OR INDICATE ZEN FOR THAT PLA.
BT
#0004




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Exhibit 15

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY (DATE TIME MONTH YR)
01 OF 01	1601011	PP	RR	AT	UUUU	ZYUW	

BOOK

MESSAGE HANDLING INSTRUCTIONS

FROM: NAVOCEANSYSCEN SAN DIEGO CA

TO: CG FIRST MARDIV

INFO CMC WASHINGTON, DC

CG MCDEC QUANTICO, VA

CG MCB CAMP PENDLETON CA

UNCLAS //N02000//

AMES IS CAPABLE OF FALLBACK TO A DEGRADED MODE OF OPERATION USING AN ALTERNATE MESSAGE ENTRY CAPABILITY IN THE EVENT OF FAILURE TO THE OCR SCANNING UNIT. IF ONLY THE SCANNING UNIT BECOMES INOPERATIVE, THE SYSTEM FIRMWARE IS CAPABLE OF ACCEPTING DD-173 FORMAT MESSAGES FROM THE KDT AND PERFORMING THE PROCESSING AND PREPARATION FUNCTIONS FOR TRANSMISSION VIA AUTODIN AND/OR PAPER TAPE. AMES RETAINS THE CAPABILITY TO OUTPUT MESSAGES TO THE AN/TYC-5A AIU OR TO THE PTP SHOULD FAILURE OCCUR TO THE CMTU AND/OR LP.

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DISTR

DRAFTER TYPED NAME TITLE OFFICE SYMBOL PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER TYPED NAME TITLE OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 1 JUL 73 173 (OCR) S/N 0102-LF-001-6000 Page GPO 1976-206-619 Exhibit 16

PATUZYUW RUWJDFN0002 1640846-UUUU--RUEACMC RUEBJMA RUWJDFC.
ZNR UUUUU
P R 130847Z JUN 78
FM NAVOCEANSYSCEN SAN DIEGO CA
TO RUWJDFN/CG FIRST MARDIV
INFO RUEACMC/CMC WASHINGTON, DC
RUEBJMA/CG MCDEC QUANTICO, VA
RUWJDFC/CG MCB CAMP PENDLETON CA
BT
UNCLAS //N02000//
AMES IS CAPABLE OF FALLBACK TO A DEGRADED MODE OF OPERATION USING AN
ALTERNATE MESSAGE ENTRY CAPABILITY IN THE EVENT OF FAILURE TO THE
OCR SCANNING UNIT. IF ONLY THE SCANNING UNIT BECOMES INOPERATIVE,
THE SYSTEM FIRMWARE IS CAPABLE OF ACCEPTING DD-173 FORMAT MESSAGES
FROM THE KDT AND PERFORMING THE PROCESSING AND PREPARATION FUNCTIONS
FOR TRANSMISSION VIA AUTODIN AND/OR PAPER TAPE. AMES RETAINS THE
CAPABILITY TO OUTPUT MESSAGES TO THE AN/TYC-5A AIU OR TO THE PTP
SHOULD FAILURE OCCUR TO THE CMTU AND/OR LP.
BT
#0002

NNNN

Exhibit 16

ATTACHMENT B

ANNOTATED BRIEFING OUTLINE OF THE FINAL STUDY REPORT

ANNOTATED BRIEFING OUTLINE
OF THE
FINAL STUDY REPORT
ON
NAVAL OUTGOING MESSAGE PROCESSING

A STUDY OF MESSAGE GENERATION AND MESSAGE PREPARATION FOR TRANSMISSION AND THE IMPACT OF AUTOMATION

I. Study objectives

A. Analyze the impact of automation on the naval outgoing message process

B. Analyze the impact of media selection on message generation and preparation

C. Develop conceptual message generation and preparation systems

1. Various levels of automation

2. Various choices of media

D. Develop an equipment data base and project system costs

II. Study background

A. *In response to* NSAP *tasking* (SURP-1-78)

B. Outgrowth of previous NSAP tasking (TH-2 75)

1. Automated message preparation feasibility study on USS OKLAHOMA CITY (May 76)

2. Subsequent request to retain feasibility system by OKLAHOMA CITY (July 77)

3. Additional request by USS KITTY HAWK to obtain automated message entry system (June 78)

III. Background

A. NOSC Code 8125 charter

1. Plans, manages and executes system development projects from requirements, through design and development, to installation and support of Marine Corps and Special Systems

2. Translates mission requirements to system requirements; develops performance requirements; performs studies; allocates functions to hardware, software and procedure; synthesizes design solutions; conducts trade-off analyses; designs and tests systems; designs and develops associated hardware, software and firmware

ATTACHMENT B

B. NOSC Code 8125 related tasking

1. Development of OCR selection criteria and industry survey of OCRE (selection report – Sept 74)
2. Development of AMES feasibility model and field evaluation for USMC (evaluation report – May 76)
3. Development of shipboard AMP/OCR entry system and feasibility testing on USS OKLAHOMA CITY – (test report – Nov 76)
4. Assembly and field demonstration of an AMES feasibility model to USAREUR – (Sept 77)
5. Development of AMES ADM for USMC – (ADM & documentation – Mar 78)
6. OPEVAL of AMES ADM by 1ST MARDIV – (test report – July 78)
7. Field testing of AMES ADM by USAREUR – (Sept 78)
8. Development of AMES system (Type A) and OCR equipment (Type C2A) specifications – (specifications – Oct 78)
9. Study of automated message preparation systems and message entry devices for Navy shipboard application – (study report – Nov 78)

IV. Study approach

A. Delineate the naval outgoing message process

B. Define the message generation and preparation functions

C. Analyze the functions in regard to automation

D. Recommend candidates for automation

E. Recommend message generation media

F. Develop conceptual systems

G. Project system costs

V. Automation goals

A. Improve message throughput

B. Decrease writer to reader time

C. Reduce or eliminate message preparation errors

D. Reduce personnel requirements

E. Reduce skill levels

ATTACHMENT B

VI. Study definitions

A. Message generation study

1. Message composition station
2. Message entry device
3. Media

B. Message preparation system

C. Message transmission system

VII. *Message generation functions*

A. Rough draft

B. Draft

C. Edit

D. Chop

E. Coordinate

F. Final approval

G. Release

VIII. Narrative message composition

A. Consists of:

1. Rough draft – writing down thoughts/data in rough form
2. Draft – conversion of rough drafts to message generation process forms and formats
3. Edit – receipt and incorporation of proposed/directed changes and *corrections*

B. Automation candidates – basic

1. Character erase/overwrite, delete, insert
2. Line delete, insert
3. Paragraph delete, insert

C. Automation candidates – advanced

1. Message storage
2. Word search
3. Search and replace, delete

ATTACHMENT B

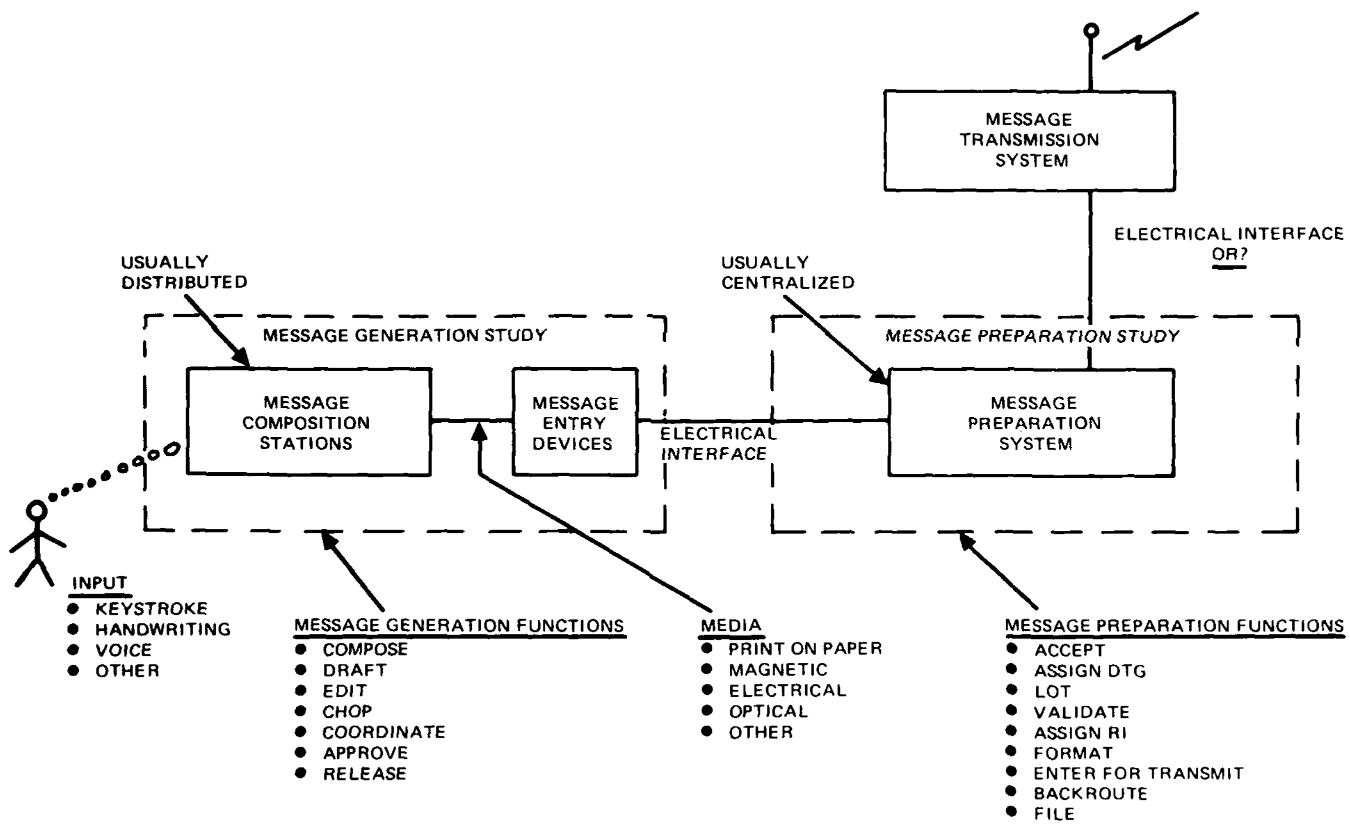

Figure AB1. Outgoing naval message processing – study definitions.

4. Word wrap, page wrap
5. Automatic paging
6. Interactive prompting
7. Input data validation

D. Equipment costs

1. Typewriter $800/unit
2. Smart typewriter (commercial grade) $5K/unit
3. Word processing system (commercial).................. $15K/unit
4. Militarized message composition aid $100K/unit
    a. KDT
    b. Processor
    c. Printer
    d. Off-line storage

E. Conclusions

1. Basic automation aids are cost effective and desirable
2. A typewriter can provide the basic automation aids if correction pages are used; allows changes to message without message retype
3. Advanced automation aids are not cost effective when used for routine message traffic except in a fully automated ship
4. Advanced automation aids are cost effective when the time spent for message composition is significant and their distribution within the ship is limited to one or two locations

IX. Pro forma message composition

A. Consists of:

1. Insertion of data into blanks of rigidly specified message formats
2. Frequent and periodic transmission for data transfer to computer processing systems

B. Automation candidates

1. Interactive prompting
2. Input data validation
3. Canned message storage
4. Canned message maintenance
5. Message storage
6. Writer need only specify the type of message and provide the data to be inserted

ATTACHMENT B

C. Equipment costs

1. MIL SPEC stand-alone system. $100K/unit
    a. KDT
    b. Processor
    c. Off-line storage
    d. Printer
2. As part of the automated message preparation system . . . . .Very small additional costs

D. Conclusions

1. This is a prime area for automation
2. Cost effective only if centrally located and part of an automated message preparation system

X. Chop and coordinate

A. Consists of:

1. Review and approval by the chain of command
2. Disclosure of message to interested parties

B. Analysis

1. Involves mostly human functions
    a. Reading
    b. Making/suggesting changes
    c. Routing
2. Requires hard copy for mark up
3. Not easily or effectively automated

XI. Approval and release

A. Consists of:

1. Formal authorized permission for message transmission by command
2. Transfer of message from the release authority to the communications center

B. Analysis

1. Involves mostly human functions
    a. Reading
    b. Making/suggesting changes
    c. Indicating approval (signature or code)
    d. Routing

2. Electrical routing to/from approval station may be cost effective
3. Not easily or effectively automated

XII. Media candidates

A. Visual (typed or printed forms)

B. Magnetic (cards, disks, tapes, etc.)

C. Electrical (hard wired)

XIII. Media evaluation

A. Typewritten page

1. Human and machine readable (using an OCR)
2. Media cost is low ($0.01 per page)
3. Equipment cost for one MCS is comparatively low (starts at $800)
4. Requires comparatively little operator training time
5. Additional equipment is not required for chop, coordination or release stations
6. Present security procedures apply
7. Readers are available and suitable

B. Optical character readers (OCR)

1. Commercial OCRs cost about $25K; MIL SPEC OCRs are not available
2. Size and weight are suitable for carry-on installation
3. State-of-the-art OCRs can tolerate (within reasonable limits)
   a. Coffee stained, coke stained, wrinkled or dirty pages
   b. Smudged or touching characters
   c. Uneven character and line spacing
   d. Uneven character print density
   e. Variations in character stroke widths
   f. Cloth ribbons
   g. Type from manual OCR font typewriters
   h. Skewed or misaligned characters or lines
   i. Page misalignment within the typewriter
4. Data integrity of OCRs is several orders of magnitude higher than that afforded by the present manual preparation system
5. Page throughput is approximately 5/minute
6. OCRs have wide use and acceptance

ATTACHMENT B

C. Magnetic media

1. Require appropriate reading-display/print device at all "read" locations
2. Equipment costs per MCS start at $7,000
3. MCS operator would require special training
4. Equipment costs for each message chop, coordination or release station are the same as those for one MCS
5. New security procedures are required
6. These media best suited for mass storage of messages

D. Electrical media

1. Require appropriate reading-display/print device at all "read" stations
2. Require installation of TEMPEST approved cables
3. Equipment cost for one MCS starts at $5,000
4. Equipment costs for each message chop, coordination or release station are the same as those for one MCS
5. Special training is required for the MCS operator
6. Require security-approved equipment, spaces and safeguards for message protection

E. Media cost comparison

See Table AB1.

XIV. Media evaluation conclusions

A. The visual (typed or printed page) media are the media of choice for all but the fully automated ship

B. Magnetic media are good for mass message storage; not well suited to the processing of outgoing messages

C. Electrical is the media of choice on the fully automated ship; electrical media cannot be justified on the basis of automated processing of outgoing message traffic only

XV. Media recommendations

A. Retain type-on-paper as prime medium for all but the fully automated ship

B. Consider electrical routing for high volume, high precedence message traffic between prespecified parties

C. Use electrical media on the fully automated ship

ATTACHMENT B

Table AB1. Media cost comparison.

MEDIA	COST ESTIMATE PER UNIT	COST ESTIMATE PER 500 MESSAGES[1]
Typewritten page	$0.01/page	$10
Magnetic[2]		
5-1/4 inch floppy disk	$ 7.00/disk	$ 1,750
8 inch floppy disk	8.50/disk	2,125
Hard disk	80.00/disk	20,000
Tape cassette	7.00/cassette	1,750
Tape mini-cartridge	18.00/cartridge	4,500
Tape cartridge	19.00/cartridge	4,750
Card	1.00/card	250
Paper tape[3]	$ 0.50/roll	$ 6.25
Electrical[4]	Very low	Very low

NOTES:

1. This represents roughly 10 days of message traffic based on USS OKLAHOMA CITY data.
2. Based on one message/unit, 50 messages/day, an average message length of 2100 characters, and the media, where applicable, is available for reuse once every 5 days; security problems associated with reusing the media are not considered.
3. Assumes an efficiency use of 40 messages/roll.
4. One time cable installation costs will be considerable.

XVI. Automation recommendations

A. Retain the typewriter as the prime message composition station for all but the fully automated ship

B. Provide a centralized pro forma message generation device

C. Judiciously provide a few commercial grade smart typewriters at high volume, narrative message generation centers

D. Use fully automated message composition stations on the fully automated ship

XVII. Message preparation functions

A. Accept

B. Prepare

C. Transmit

D. Backroute

ATTACHMENT B

E. File

F. Ancillary

XVIII. Message preparation functions analysis

A. Message acceptance

1. Paper is the most desirable medium

a. Message must be logged and verified
b. Message must be inspected
c. Special handling may be required

2. Automation is not cost effective

a. Reader/display required
b. Mostly human involvement required

B. Preparation for transmission

1. Automation can greatly benefit this function

a. Improves accuracy
b. Reduces preparation time
c. Reduces personnel

2. Candidates for automation

a. Assign and log unique DTG
b. Validate message parameters
c. Determine format and delivery circuit
d. Assign routing indicators
e. Prepare message in correct format and LMF
f. Place message in proper outgoing queue

C. Message transmission

1. Requires interconnect of an automated message preparation system to an automated communications center

2. Requires development of software to control the interface properly

3. Automation makes sense in conjunction with an automated communication system such as NAVMACS

D. Message backrouting

1. Cost effective candidates for automation

a. Determine recipients
b. Duplicate, collate and slot

ATTACHMENT B

2. Automation of the delivery function is cost effective only on the fully automated platform
    a. Implies electrical routing
    b. High cost for benefit
3. Should be integrated to a MRDIS or equivalent if available

E. Ancillary functions
1. File maintenance
    a. Prime area for automation
    b. Preferred medium is magnetic
2. Customer requests
    a. Prime area for automation assistance
    b. Access to data base is the primary task to be automated
3. Record keeping and report generation is prime area for automation/automation assistance
4. File destruction
    a. Highly dependent on file media
    b. Not prime for automation

XIX. AMPS – Level I

A. Automated functions:
1. Input DD-173 (or equivalent) via:
    a. Media reader
    b. Paper tape reader (fallback mode)
    c. Local and remote KDTs
2. Validate header and classification information
3. Assign DTG, SSN and/or TOF (automatically or manually)
4. Convert message into either plaindress or abbreviated plaindress for ACP 126 modified
5. Semi-automatically section the message
6. Output formatted message:
    a. Electrically over a cable to NAVMACS
    b. To PTP in either ITA#2 or ASCII
7. Provide proof of transmission copy and/or journal log
8. Compile message statistics
9. Permit editing of the message through use of correction pages
10. Provide query/response interaction with the operator
    a. System control
    b. System parameter selection
    c. Header field editing/correction
11. Provide on-line and off-line system self-test features

ATTACHMENT B

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K	1	$ 30K	1	$ 30K		
CPU, AN/AYK-14(V)						
CPU, AN/UYK-7, $550K						
CPU, AN/UYK-7, $865K						
KDT, AN/USQ-69, $16K	2	32K	2	32K		
PTR/P, RD-397/U, $17K	1	17K	1	17K		
LP, TT-624(V)/UG, $23K	1	23K	1	23K		
CMTU, AN/USH-26(V), $23K						
MTU, RD-358, $125K						
MDU, RD-281/UYK, $400K						
PCR, $20K						
OCR, $50K			1	50K		
MMMVT, $66K	1	66K				
EMMVT, AN/USQ-69, $16K						
MMMCT, $89K	2	178K				
VMMCT, SELECTRIC II, $1K			4	4K		
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K						
MMR, $20K	1	20K				
MRDIS, $125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		366K		156K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		200K		200K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		566K		356K		

*Unknown

ATTACHMENT B

C. Conclusions

1. Low cost, low risk
2. Automates the processing of 80–90% of typical outgoing message traffic
3. Suitable for small ships
4. Significant enhancement even to large ships

XX. AMPS - Level II

A. Automated functions:

1. Includes all of the capabilities of AMPS I
2. Validate addressee and verify classification information
3. Assign an RI to each PLA according to:
    a. Message security classification
    b. Output format
4. Assign the required RIs to each AIG
5. Permit message handling instructions to be added to format header lines
6. Convert message into either plaindress or abbreviated plaindress for:
    a. JANAP 128
    b. ACP 127
    c. ACP 126
7. Create separate history and journal file for all messages transferred to NAVMACS and/or the PTP
8. Provide non volatile file storage for a minimum of:
    a. 200 PLAs and corresponding RIs
    b. 5 AIGs and associated RIs
9. Provide off-line message retrieval from history file
    a. Retrieval parameters are DTG, SSN, and/or TOF
    b. Output retrieved message to the LP and/or PTP
10. Provide off-line retrieval from the journal file to obtain a hardcopy printout of an entire day's log

ATTACHMENT B

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K						
CPU, AN/AYK-14(V)	1	$ 60K	1	$ 60K		
CPU, AN/UYK-7, $550K						
CPU, AN/UYK-7, $865K						
KDT, AN/USQ-69, $16K	2	32K	2	32K		
PTR/P, RD-397/U, $17K	1	17K	1	17K		
LP, TT-624(V)/UG, $23K	1	23K	1	23K		
CMTU, AN/USH-26(V), $23K	1	23K	1	23K		
MTU, RD-358, $125K						
MDU, RD-281/UYK, $400K						
PCR, $20K						
OCR, $50K			1	50K		
MMMVT, $66K	1	66K				
EMMVT, AN/USQ-69, $16K						
MMMCT, $89K	3	267K				
VMMCT, SELECTRIC II, $1K			6	6K		
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K						
MMR, $20K	1	20K				
MRDIS, $125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE		508K		211K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		400K		400K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		908K		611K		

*Unknown

ATTACHMENT B

C. Conclusions

1. Moderate cost, low risk
2. Automates the processing of 90% of typical outgoing message traffic
3. Suitable for medium to large ships
4. Most cost effective system

XXI. AMPS - Level III

A. Automated functions:

1. Includes all the capabilities of AMPS I and II
2. Input DD-173 (or equivalent) formatted messages via:
   a. Punched card reader or magnetic media reader (remote or local)
   b. Additional local KDT
3. Assign an RI to each PLA according to the:
   a. LMF of the message
   b. Delivery circuit required for transmission
4. Add message handling instructions to the format header lines based on routing information contained in the PLA/RI file
5. Segment the message
6. Section the message
7. Convert input message into JANAP 128 or ACP 126 modified data pattern upon request
8. Determine format and delivery circuit and place formatted message in proper outgoing queue by precedence
9. Retrieve message from outgoing queue (FIFO by precedence) and transmit over the proper delivery circuit
10. Obtain acknowledgement for the message and log transmission or cancellation time
11. Retrieve messages from the history file based on any one or any combination of DTG, SSN, TOF and originator's PLA
12. Provide capability to modify and automatically retransmit a message contained in the history file
13. Provide capability to automatically readdress a message contained in the history file
14. Compile detailed message statistics for the purpose of automatically generating on-ship and off-ship communications reports or messages
15. Generate pro forma messages
    a. Accept and insert input data
    b. Storage of 50 canned message formats
16. Determine recipients of backrouted message
17. Prepare copies of message to be backrouted
    a. Duplicate
    b. Collate
    c. Slot

ATTACHMENT B

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K						
CPU, AN/AYK-14(V)						
CPU, AN/UYK-7, $550K	1	$ 550K	1	$ 550K		
CPU, AN/UYK-7, $865K						
KDT, AN/USQ-69, $16K	3	48K	3	48K		
PTR/P, RD-397/U, $17K	1	17K	1	17K		
LP, TT-624(V)/UG, $23K	1	23K	1	23K		
CMTU, AN/USH-26(V), $23K						
MTU, RD-358, $125K	1	125K	1	125K		
MDU, RD-281/UYK, $400K	1	400K	1	400K		
PCR, $20K	1	20K	1	20K		
OCR, $50K			1	50K		
MMMVT, $66K	2	132K				
EMMVT, AN/USQ-69, $16K						
MMMCT, $89K	6	534K				
VMMCT, SELECTRIC II, $1K			12	12K		
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K						
MMR, $20K	2	40K	1	20K		
MRDIS, $125K	1	125K		125K		
COST SUMMARIES						
BASIC SYSTEM HARDWARE		2014K		1390K		
SOFTWARE DEVELOPMENT AND DOCUMENTATION		1500K		1500K		
SYSTEM DESIGN		*		*		
SYSTEM ASSEMBLY		*		*		
SYSTEM INTEGRATION AND TESTING		*		*		
SYSTEM DOCUMENTATION		*		*		
SYSTEM INSTALLATION		*		*		
LIFE CYCLE SUPPORT		*		*		
HARDWARE AND SOFTWARE COSTS		3514K		1890K		

*Unknown

ATTACHMENT B

C. Conclusions

1. High cost, low to moderate risk
2. Automates the processing of essentially all outgoing message traffic
3. Suitable for large ships
4. Provides only a small increase in capability over AMPS II at considerable increase in cost

XXII. AMPS – LEVEL IV

A. Automated functions:

1. Includes all of the capabilities of AMPS I, AMPS II and AMPS III
2. Input DD-173 (or equivalent) formatted messages via:
   a. Two local KDTs
   b. Eight (maximum) remote KDTs
3. Remote KDTs also capable of:
   a. Message generation functions
   b. Customer request
4. Automate the acceptance function
   a. Observe message precedence and handle accordingly
   b. Ensure message has been properly staffed
   c. Check for a valid release authority
   d. Log receipt time
5. Distribute/deliver backrouted message copies and requested message file copies to the proper remote LP (up to 13 LPs)
6. Provide security safeguards to ensure that remote KTDs and LPs, as well as their operators are cleared to handle classified messages

B. System Costs

EQUIPMENT TYPE, NOMENCLATURE AND UNIT COST	MAGNETIC MEDIA		VISUAL MEDIA		ELECTRICAL MEDIA	
	QTY	COST	QTY	COST	QTY	COST
CPU, $30K						
CPU,AN/AYK-14(V)						
CPU, AN/UYK-7, $550K						
CPU, AN/UYK-7, $865K					1	$ 865K
KDT, AN/USQ-69, $16K					3	48K
PTR/P, RD-397/U, $17K					1	17K
LP, TT-624(V)/UG, $23K					6	138K
CMTU, AN/USH-26(V), $23K						
MTU, RD-358, $125K					1	125K
MDU, RD-281/UYK, $400K					1	400K
PCR, $20K					1	20K
OCR, $50K						
MMMVT, $66K						
EMMVT, AN/USQ-69, $16K					2	32K
MMMCT, $89K						
VMMCT, SELECTRIC II, $1K						
AN/USQ-69, EMMCT, TT-624(V)/UG, $39K					8	312K
MMR, $20K					1	20K
MRDIS, $125K						
COST SUMMARIES						
BASIC SYSTEM HARDWARE						1977K
SOFTWARE DEVELOPMENT AND DOCUMENTATION						3000K
SYSTEM DESIGN						*
SYSTEM ASSEMBLY						*
SYSTEM INTEGRATION AND TESTING						*
SYSTEM DOCUMENTATION						*
SYSTEM INSTALLATION						*
LIFE CYCLE SUPPORT						*
HARDWARE AND SOFTWARE COSTS						4977K

*Unknown

ATTACHMENT B

C. Conclusions

1. Very high cost, moderate risk
2. Automates all message preparation functions
3. Practical only on fully automated ships

XXIII. Summary

A. The visual media are familiar and comfortable; present procedures – security and otherwise – apply; damaged media data recovery is high; readers are available and suitable; well suited to the outgoing message process

B. Magnetic media are well suited to mass message storage; not well suited to the message generation or preparation process

C. Electrical media are cost effective only on the fully automated ship

D. Message generation functions, with the exception of composition aids, tend not to be candidates for automation

E. Message preparation functions, in general, tend to be high payoff candidates for automation

XXIV. Recommendations

A. Automate all message generation and preparation functions and use electrical media only on the fully automated ship

B. Otherwise

1. Use type or print on paper as the prime message medium
2. Retain the typewriter as the prime message composition station
3. Provide a few judiciously located smart typewriters for high volume stations
4. Provide electrical routing between a few prespecified stations for high volume, high precedence traffic
5. Provide all but the fully automated ship with an AMPS Level II system – upgraded or downgraded as appropriate

ATTACHMENT B

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